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Chlorinated Pesticides and PCBs
Total Maximum Daily Load
(Water Cleanup Plan)

Submittal Report

Draft

September 2005
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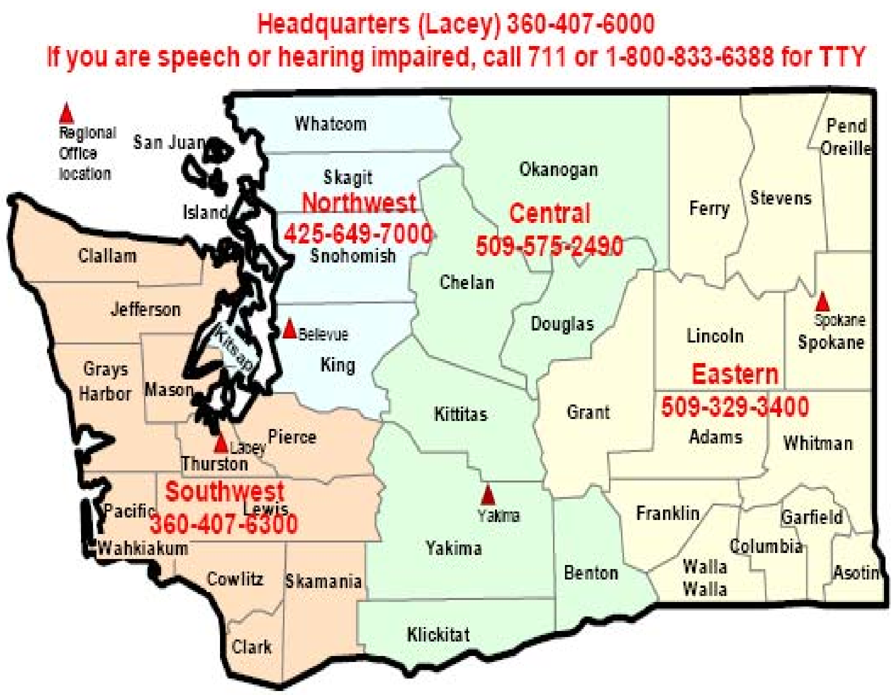

Map of Regions

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Introduction

The Washington State Department of Ecology (Ecology) is establishing a water quality clean-up plan or total maximum daily load (TMDL) for the Washington State portion of the Walla Walla basin that covers the pollution parameters of chlorinated pesticides and PCBs. This TMDL will address potential impairments of beneficial uses of the Walla Walla River and its tributaries in Washington State. Ecology does not have jurisdiction over the portion of the watershed in Oregon State that comprises roughly a quarter of the entire Walla Walla watershed. However, some load allocations are given in this TMDL for streams in Washington where the headwaters are in Oregon. Therefore, Ecology is mindful of the need to develop and foster strong and effective cross-border ties that will help coordinate implementation efforts and ensure water quality is protected across the basin.

Under the Clean Water Act, every state has its own water quality standards designed to protect, restore, and preserve water quality. Water quality standards consist of designated uses (such as cold-water biota and drinking water supply) and numeric standards to achieve those uses. When a water body fails to meet water quality standards after application of best management practices (BMPs) and required technology-based controls, the Clean Water Act requires that the state place the water body on a list of impaired water bodies and to prepare an analysis called a TMDL. BMPs usually apply to nonpoint sources and are defined in WAC 173-201A as ‘physical, structural and/or managerial practices approved by the department that, when used singularly or in combination, prevent or reduce pollutant discharges.’ Technology-based control typically applies to point sources and is the best technology available that is economically achievable and can be applied to facilities to reduce pollution discharges. The U.S. Environmental Protection Agency (EPA) has established regulations [40 Code of Federal Regulations (CFR) Part 130] and developed guidance for setting TMDLs (EPA, 1991). In June 2002, Washington State Department of Ecology developed its own guidance (which has been used in the writing of this document) for setting TMDLs.

The goal of a TMDL is to ensure that the impaired water body will attain water quality standards within a reasonable time period. A TMDL includes a written, quantitative assessment of the water quality problem and of the pollutant sources that cause the problem. The TMDL determines the amount of a given pollutant (called the loading capacity) that can be discharged to the water body and still meet water quality standards and, subsequently, allocates that load among the various sources. If the pollutant comes from a discrete source (referred to as a point source) such as an industrial facility’s discharge pipe, that facility’s share of the loading capacity is a wasteload allocation. If the pollution comes from a diffuse source (referred to as a nonpoint source) such as runoff from roads, parking lots, and fields, that share is a load allocation. However, each location that makes up the diffuse source does not receive an individual allocation. Load allocations are assigned to the broad nonpoint source.

The TMDL must also consider seasonal variations and include a margin of safety that takes into account any lack of knowledge about the causes of the water quality problem or its loading capacity. The sum of the individual allocations and the margin of safety must be equal to or less than the loading capacity.

The general purposes of this submittal document are to:

- Provide an analysis of chlorinated pesticides and PCB data from the Walla Walla River and tributaries from sampling performed by the Environmental Assessment Program (EAP) of the Washington State Department of Ecology from May 2002 through September 2003.
- Identify potential point and nonpoint sources of chlorinated pesticides and PCB pollution.
- Summarize ongoing and planned actions that will allow the Walla Walla River and its tributaries to meet state water quality standards.
- Summarize proposed monitoring activities to verify whether those standards are being met.
- Fulfill requirements of the federal Clean Water Act.

A detailed implementation plan (DIP) will be developed within one year after the TMDL approval by the Environmental Protection Agency (EAP) and will be based on the information presented in this document.

Background

Basin Description

The Walla Walla River is located in the southeast corner of Washington State (Figure 1). The river extends 61 miles from its headwaters in Oregon to its confluence with the Columbia River. The drainage basin covers approximately 1,760 square-miles. Approximately three-quarters (73 percent) of the drainage and the last 40 miles of the mainstem lie within Washington. In downstream order, the major Washington tributaries are Russell Creek, Reser Creek, Cottonwood Creek, Birch Creek, Yellowhawk Creek, Stone Creek, Garrison Creek, Cold Creek, Mill Creek, East Little Walla Walla River, West Little Walla Walla River, Dry Creek, Mud Creek, Pine Creek, the Touchet River, and the Garden~~i~~a Creek.

Mill Creek flows from municipal watershed conditions in the Blue Mountains. Most of the city of Walla Walla's drinking water comes from a 36 square-mile protected portion of upper Mill Creek. Approximately 14 miles below the waterworks, part of its flow is diverted to Yellowhawk and Garrison creeks year round for irrigation purposes (Nicholson, pers. comm., 2005).

The two major permitted discharges in the basin are the Walla Walla Wastewater Treatment Plant (WWTP) that discharges to Mill Creek at river mile (R.M.) 5.4 and the College Place WWTP that discharges to Garrison Creek at R.M. 1.0. Yellowhawk, Garrison, and Mill creeks enter the Walla Walla River between R.M. 37.9 and 33.6. The drainage area of the greater Mill Creek watershed is 96 square-miles.

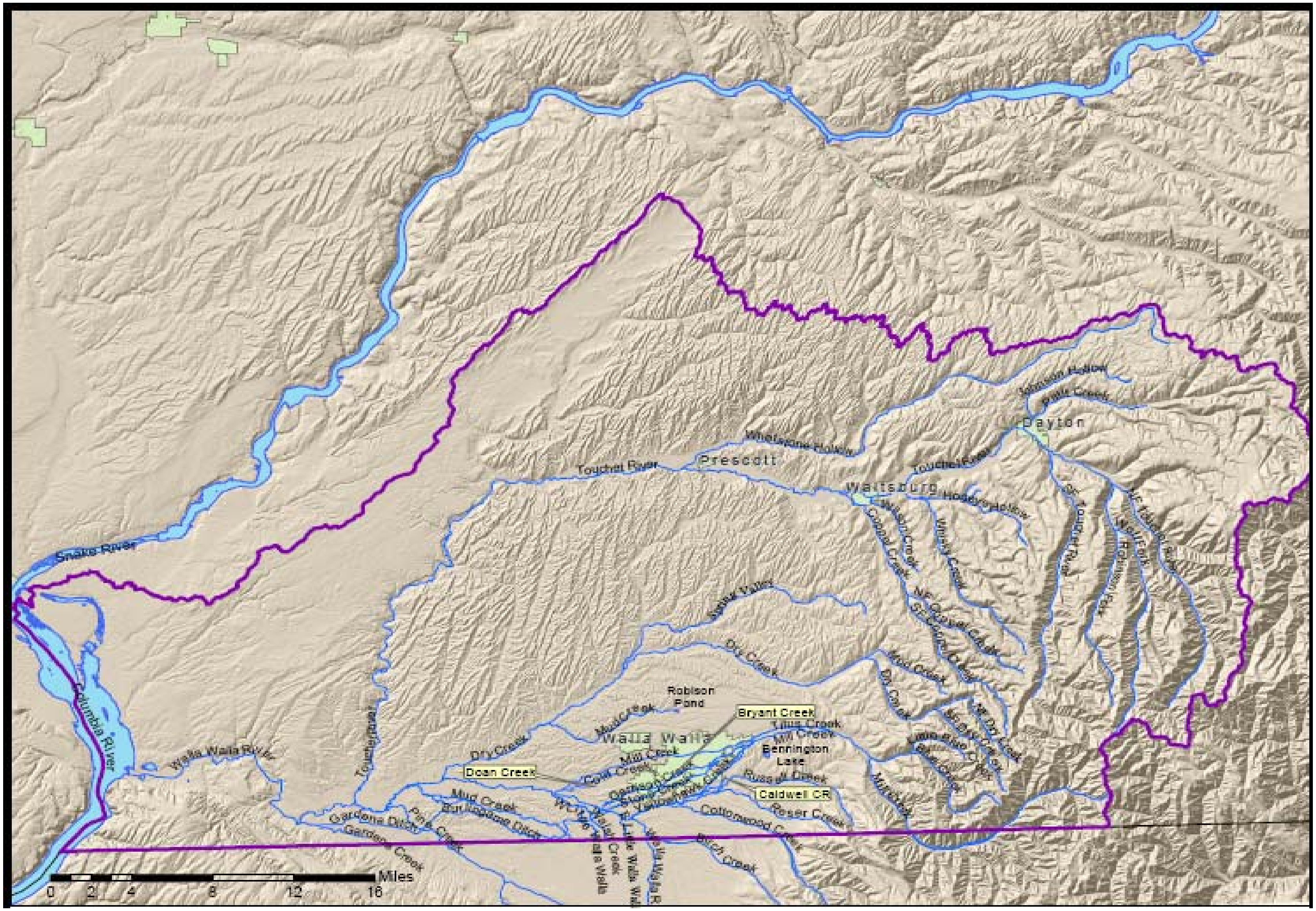

Figure 1. Walla Walla River Basin

The Washington side of the Walla Walla basin has few urban areas. The Washington State Office of Financial Management's (OFM) most recent census results show there were approximately 56,700 people living in Walla Walla County in 2004. The major cities are Walla Walla and College Place, with a combined population of less than 40,000. Starting as early as the 1920s, the principal form of land use was production of small grains such as wheat and barley, and forage crops like alfalfa, and row crops (Mapes, 1969). Currently, wheat, pasture, potatoes, alfalfa seed, and hay are the largest percentage of the irrigated crops. Pasture makes up roughly a quarter of irrigated lands on the Washington side of the Walla Walla basin. Other crops include onions, peas, grapes, apples, asparagus, and barley. Roughly 25 percent of the total acreage in the Walla Walla basin is under the Conservation Reserve Program (CRP), and just less than 1 percent is under the Conservation Reserve Enhancement Program (CREP) (Walla Walla County and Walla Walla Basin Watershed Council, 2004). Figure 2 shows land use patterns as of the late 1980s/early 1990s. About 91 percent of land on the Washington side of the Walla Walla basin is privately owned with approximately 6 percent and 2 percent owned by federal and state entities respectively (Hashim and Stalmaster, 2004).

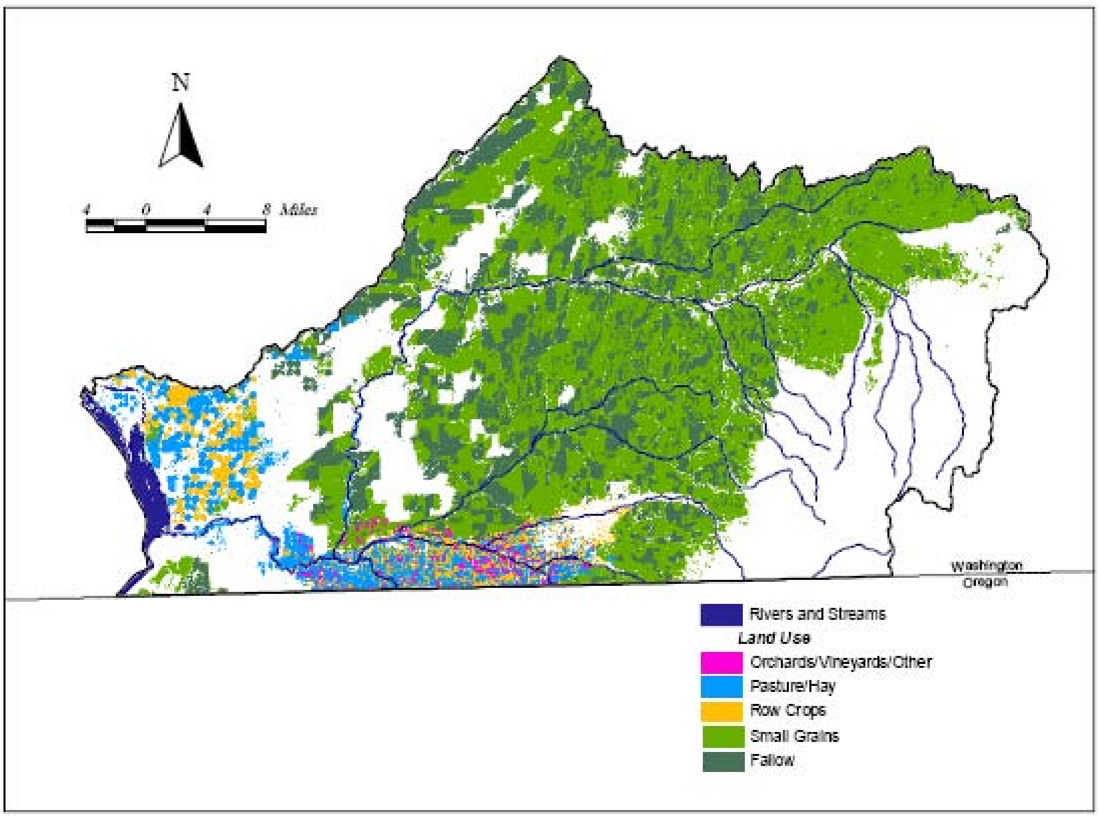

Figure 2. Land Use in the Walla Walla Basin, 1986-1996 data

The Walla Walla basin consists primarily of ridges and rolling hills interspersed with valleys. The ridges and hills are underlain by loessal (windblown silt) formations up to 250 feet thick, except to the west where the soils are sandy. Soils in the lower valleys are relatively highly alkaline that may increase the tendency of the chlorinated pesticides and PCBs addressed in this study to bind with soil particles in these areas. The valley floors are underlain by floodplain alluvium ranging in grain size from gravel to silt. Beneath the floodplain alluvium are clay units as much as 500 feet thick. Most benches within the valleys and terraces on the valley sides are composed of sand and silt of the Touchet Beds deposited by catastrophic floods from Montana's glacial Lake Missoula. The last flood series was between about 15,000 and 13,000 years ago. Under all the sediment, and exposed at the surface locally, are the Columbia River Basalts (CRB) which are thousands of feet of lava that erupted 17 to 6 million years ago. There are two major aquifers in the area. The basalts are the deep confined aquifer. The gravels are the shallow unconfined aquifer. In general, streams are in hydraulic continuity with the shallow gravel aquifer. In the Walla Walla Valley the clays serve to slow water movement between the shallow aquifer and the deep basalt aquifer (Newcomb, 1965, and Carson and Pogue, 1996). Folds and faults in the basalt can work as natural dams, creating impediments to groundwater flow, large differences in groundwater pressure, and fluctuations in water levels (HDR/EES Inc., 2005).

Elevation exerts significant control over climate in the Walla Walla basin, presenting temperature and precipitation gradients from west to east with the rise in elevation towards the Blue Mountains. Local climate varies from warm and semiarid in the western lowlands that lie in the rain shadow of the Cascade Mountains, to cool and relatively wet at higher elevations in the Blue Mountains. The average temperatures range from 20° to 25° F in the winter to 90° F to 95°F in the summer, with summer highs peaking in July and decreasing in late August. The lower west end of the basin averages less than 10 inches of precipitation per year (extremes can be as low as 4 inches), while the higher east end of the basin averages 40 to 60 inches of precipitation per year (HDR/EES Inc., 2005).

Although highly altered by grazing, prescribed burning, wildfires, and agriculture, remnants of the original grassland and shrub-steppe vegetation remain. However, the preliminary draft of the Walla Walla Watershed Plan (January 2005, section 3 pg. 4) states that most disturbed areas not under cultivation are dominated by non-native invasive species such as cheat grass (*Bromus tectorum*), velvet grass (*Holcus lanatus*), yellow star thistle (*Centaurea solstitialis*), barnyard grass (*Echinochloa crusgalli*), tansy (*Tanacetum vulgar*), and rattlegrass (*Bromus brizaeformis*). Of these, *Bromus tectorum* and *Centaurea solstitialis* may currently be the most significant invasive species (Schirman, *pers. comm*., 2005). Riparian vegetation is limited in most areas throughout the basin. Areas of shrubs and grasses in the western lowlands gradually give way to the open woodlands and then transition into the upland coniferous forests of the Blue Mountains at higher elevations in the east (HDR/EES Inc., 2005).

Ecology's Chlorinated Pesticide and PCB Study

In 1996, the Walla Walla River was listed by the state of Washington under Section 303(d) of the Clean Water Act for non-attainment of the EPA human health criteria for 4,4'-DDE, 4,4'-DDD, dieldrin, chlordane, hexachlorobenzene, heptachlor epoxide, and PCB-1260 in edible fish tissue. The listings are based on sampling done by Ecology in 1993 (Davis *et al*., 1995). The 1996 303(d) listings were maintained on the 1998 and draft 2002/2004 lists (Table 3). Garrison Creek, a Walla Walla tributary, was also proposed for listing in 2002/2004 due to human health violations of standards for DDT compounds and hexachlorobenzene in water samples (White et al., 1998). Prior to Ecology's TMDL evaluation, toxaphene was absent from Washington's most recent toxin listings for the Walla Walla as it was previously unknown to violate water quality standards. However, Ecology's 2002-2003 TMDL evaluation found Pine Creek to have relatively high concentrations of toxaphene, and is shown in this report as impaired.

Chlorinated pesticides, their breakdown products, and polychlorinated biphenyls (PCBs) are no longer used in the United States, having been banned in the 1970s and 1980s for ecological concerns. They are now classed as probable human carcinogens by EPA. Chlorinated pesticides have a range of possible negative human health effects, including nervous system, digestive system, immune system, and reproductive system effects. They do not breakdown easily and bind strongly with the soil, and so often persist in the environment for many years. In the Walla Walla River watershed, the primary source of chlorinated pesticides is thought to be from soil erosion from agricultural lands and runoff from urban areas.

Like chlorinated pesticides, PCBs (Polychlorinated Biphenyls) also breakdown very slowly and persist in the environment. For this reason, both chlorinated pesticides and PCBs are commonly referred to as 'legacy pollutants'. PCBs do not burn easily, have been used widely as coolants and lubricants, and because they do not conduct electrical charges readily, they have been used as insulators in electrical transformers. PCBs can have severe human health effects, possibly causing stomach, liver and kidney damage, skin irritation, and thyroid gland injuries. They are also suspected to be probable human carcinogens. PCBs released into the air can enter the land or water by settling or from runoff in snow and rain. Both chlorinated pesticides and PCBs can build up in fish tissue and can reach levels much higher than those in the water, and can accumulate further in humans through fish consumption. Detailed profiles including use, regulations, environmental occurrence, and health effects have been prepared by the agency for Toxic Substances and Disease Registry (see Appendix F).

In 2002-2003, Ecology initiated a total maximum daily load (TMDL) evaluation of chlorinated pesticides and PCBs in the Walla Walla River and its tributaries. The evaluation was based on a field study that sampled concentrations of these pollutants in fish tissue and the water column, including sampling of the waste water treatment plant effluents for the cities of Walla Walla and College Place. The study area included the mainstem of the Walla Walla River and its tributaries from the Oregon border to the Columbia River. Tributary sampling was confined to sites at or near their mouths. Water sampling was done primarily on a quarterly basis: May-June, August-September, November-December of 2002, and November-December of 2003. Fish sampling was limited to resident mainstem species with upper river fish being analyzed separately from lower river fish (see the sampling section under *Technical Analysis* for further information).

The primary goals of the field study for the Walla Walla River chlorinated pesticide/PCB TMDL were to 1) quantify water column concentrations and loadings of 303(d) listed pesticides and PCBs in the Walla Walla mainstem, major tributaries, and significant point sources; 2) recommend numerical water quality targets that will result in fish meeting human health standards; and 3) propose load allocations to meet the targets. In pursuit of these goals, sufficient data were obtained to allow an assessment of human health risk from fish consumption. Benchmarks were established to gauge future improvements in water quality.

Historical application of chlorinated pesticides to soils and crops is the primary source of these chemicals in rivers and streams in agricultural areas like the Walla Walla basin. Because chlorinated pesticides bind strongly to soil particles, the key to meeting pesticide standards in the Walla Walla River and its tributaries is to reduce the amount of soil entering these water bodies. A report by Economic and Engineering Services, Inc. (EES) has concluded that erosion of fine sediment is a problem in the lower Walla Walla basin (EES, 2003). EES identified a number of sources of sediment including road-building and logging activities in the upper reaches of tributaries, recreational vehicle use, and urban runoff. They concluded, however, that “given the predominance of agricultural land use in the watershed, agricultural practices have been identified as the principal source of fine sediment.” Historically, agricultural areas have been large contributors to the suspended sediment problem in some drainages in the Walla Walla. Studies conducted in the 1960s showed yields of suspended sediment were greatest in the highly cultivated Touchet River and Dry Creek drainage basins that were contributing up to 80 percent of the total sediment load to the Walla Walla River (Mapes, 1969). Soils in these two drainages consist of well-drained silty loams and very fine sandy loams that are highly susceptible to erosion from runoff. Recently, much work has been done in the area to address agricultural sources of the problem.

Total suspended solids (TSS) and turbidity are proposed as water quality indicators and surrogate numerical targets for chlorinated pesticides in the Walla Walla River and its tributaries. Setting water quality targets based on TSS and turbidity has the advantage of translating more directly into land use practices and being easier and less expensive to monitor than trace chemical concentrations. Additionally, TSS and turbidity levels in rivers and streams have a direct and quantifiable effect on the health of fish and other aquatic organisms as well as aesthetic values.

Applicable Criteria

The Washington State Water Quality Standards are published pursuant to Chapter 90.48 of the Revised Code of Washington (RCW). The authority to adopt rules, regulations, and standards as necessary to protect the environment is vested with the state Department of Ecology. Under Section 303(c)(3) of the federal Clean Water Act, the EPA Regional Administrator approves the water quality standards adopted by the state. Through adoption of these standards, Washington State has designated certain characteristic uses to be protected and the criteria necessary to protect these uses (WAC 173-201A).

Although the Washington State Water Quality Standards were revised and adopted by the state on July 1, 2003, the standards from November 1997 will be used for this TMDL. The new water quality standards will not take effect for projects that require federal action until EPA, U.S. Fish and Wildlife Service, and the NOAA Fisheries approve the new standards. TMDLs under development with field work completed will continue to use the 1997 version of the water quality standards, per Ecology document *Concise Explanatory Statement and Responsiveness Summary for the Adoption of Water Quality Standards, Chapter 173-201A WAC* published July 1, 2003. At the time of writing this report, revisions to the water use and criteria classes (WAC 173-201A-030) and toxic substances sections (WAC 173-201A-040) had not yet been approved, thus the 1997 standards are employed.

It should be noted that the adoption of the revised state water quality standards will not change the chlorinated pesticide and PCB standards in the Walla Walla watershed, which are based on human health criteria.

Under WAC 173-201A-030 (1997) the Walla Walla River is a Class A water body. The characteristic beneficial uses of a Class A water body are described in WAC 173-201A-0303 (1997) as:

> *Characteristic uses shall include, but not be limited to, the following:*
> *(i) Water supply (domestic, industrial, agricultural).*
> *(ii) Stock watering.*
> *(iii) Fish and shellfish:*
> *Salmonid migration, rearing, spawning, and harvesting.*
> *Other fish migration, rearing, spawning, and harvesting.*
> *Clam, oyster, and mussel rearing, spawning, and harvesting.*
> *Crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing, spawning, and harvesting.*
> *(iv) Wildlife habitat.*
> *(v) Recreation (primary contact recreation, sport fishing, boating, and aesthetic enjoyment).*
> *(vi) Commerce and navigation.*
>
> [WAC 173-201A-030(2)(b)]

State law does not establish a ranking priority among the beneficial uses, but the individual waters are expected to support all uses within the classification.

Toxic Substances: Washington State Regulations

WAC 173-201A-030 states the following with regard to toxic substances:

> *(vii) Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see WAC 173-201A-040 and 173-201A-050).*

Toxic~~s~~ substances are further addressed in WAC 173-201A-040 as follows (selected sections):

> *(1) Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department.*
>
> *(2) The department shall employ or require chemical testing, acute and chronic toxicity testing, and biological assessments, as appropriate, to evaluate compliance with subsection (1) of this section and to ensure that aquatic communities and the existing and characteristic beneficial uses of waters are being fully protected.*
>
> *(5) Concentrations of toxic and other substances with toxic propensities not listed in Subsection (3) of this section shall be determined in consideration of USEPA Quality Criteria for Water, 1986, as revised, and other relevant information as appropriate. Human health-based water quality criteria used by the state are contained in 40 CFR 131.36 (known as the National Toxics Rule).*
>
> *(6) Risk-based criteria for carcinogenic substances shall be selected such that the upper-bound excess cancer risk is less than or equal to one in one million.*

Washington State water quality criteria that apply to 303(d) listed pesticides and PCBs in the Walla Walla drainage are shown in Table 1 [from sections (3) and (5) of WAC 173-201A-040]. The human health criteria are for a one in one million increased lifetime cancer risk from consumption of water and fish or fish only. A fish consumption rate of 6.5 grams per day and a water consumption rate of 2 liters per day are assumed. These criteria were promulgated for Washington in the EPA National Toxics Rule (40 CFR 131.36).

Table 1. Applicable Washington State Water Quality Criteria* for Chlorinated Pesticides and PCBs (ng/L; parts per trillion).

	Criteria for Protection of Aquatic Life			Criteria for Protection of Human Health	
Chemical	Freshwater Acute	Freshwater Chronic		Water and Fish Consumption	Fish Consumption
4,4'-DDT				0.59	0.59
4,4'-DDE				0.59	0.59
4,4'-DDD				0.83	0.84
DDT (and metabolites)	1,100	1.0			
Dieldrin	2,500	1.9		0.14	0.14
Heptachlor	520	3.8		0.21	0.21
Heptachlor epoxide				0.10	0.11
Hexachlorobenzene				0.75	0.77
Chlordane	2,400	4.3		0.57	0.59
Toxaphene	730	0.2		0.73	0.75
PCBs	2,000	14		0.17	0.17

*WAC 173-201A-040 (1997 version http://www.ecy.wa.gov/programs/wq/swqs/wac173201a-1997.pdf)

Toxic Substances: Oregon State Regulations

Approximately one quarter of the Walla Walla drainage lies in Oregon State and does not fall under Washington State Department of Ecology's jurisdiction. Beneficial uses and water quality standards for the surface waters of the state of Oregon are codified in the Oregon Administrative Rules (OAR) Chapter 340, Division 41. Beneficial uses for the Walla Walla River basin are given in OAR 340-041-0330 and are shown below

Beneficial Uses	Walla Walla River Mainstem from Confluence of North and South Forks to State Line	All Other Basin Streams
*Public domestic water supply	X	X
*Private domestic water supply	X	X
Industrial water supply	X	
Irrigation	X	X
Livestock watering	X	X
Anadromous fish passage	X	X
Salmonid fish rearing	X	X
Salmonid fish spawning	X	X
Resident fish & aquatic Life	X	X
Wildlife & hunting	X	X
Fishing	X	X
Boating	X	X
Water contact recreation	X	X
Aesthetic quality	X	X
Hydro power		X

*With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards.

The newly adopted Oregon Administrative Rule (OAR) 340-041-0033 states the following with regard to toxic substances.

> *(1) Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare of aquatic life, wildlife, or other designated beneficial uses.*
>
> *(2) Levels of toxic substances in waters of the state may not exceed the applicable criteria listed…*

The revised adopted toxics criteria in Oregon Administrative Rule (OAR) 340-0410-0033 are not Water Quality Standards as defined under the Clean Water Act as they have not received EPA approval. However, as of February 15, 2005, Oregon Department of Environmental Quality (DEQ) has chosen to use the new criteria to produce TMDLs where they are overly protective with regard to the 'applicable' water quality standards (Fitzpatrick, M. pers. comm., 2005). Where the 'old' criteria are more stringent these continue to be used for Oregon TMDLs until the new criteria are approved by the EPA. A complete list of the more stringent criteria can be found in Table 33A of Division 41 at http://www.deq.state.or.us/wq/wqrules/wqrules.htm. It should be noted that Table 33A values cannot yet be used for *listing* a water body as impaired because those standards are yet be approved by EPA. Table 2 shows the new more stringent Oregon State criteria for the toxins addressed in this submittal report. Figures in **bold** represent the 'old' criteria that continue to be employed in Oregon TMDLs where they are more stringent than the new criteria.

Table 2. Oregon State Water Quality Criteria* for Chlorinated Pesticides and PCBs (ng/L; parts per trillion figures in bold represent 'old' criteria still in use where they are more stringent).

	Criteria for Protection of Aquatic Life			Guidance Values for the Protection of Human Health	
Chemical	Freshwater Acute	Freshwater Chronic		Water and Fish Consumption	Fish Consumption
4,4'-DDT	1,100	1.0		**0.024**	**0.024**
4,4'-DDE				0.22	0.22
4,4'-DDD				0.31	0.31
Dieldrin	240	**1. 9**		0.052	0.052
Heptachlor	520	3.8		0.079	0.079
Heptachlor epoxide	520	3.8		0.039	0.039
Hexachlorobenzene				0.28	0.29
Chlordane	2,400	4.3		**0.46**	**0.48**
Toxaphene	730	0.2		0.28	0.28
PCBs	2,000	14		0.064	0.064

*OAR 340-041-0033 ('new' criteria) and OAR 340-041-0685 ('old' criteria).

Water Quality and Resource Impairments

Sampling conducted in 1993 indicated the Washington State's water quality standards had been violated in various water bodies of the Walla Walla drainage and these were then considered 'impaired.' Several of these water bodies were included on both the state's 1996 and 1998 Section 303(d) list for non-attainment of the EPA's human health criteria for 4,4'DDE; 4,4'DDD; dieldrin; chlordane; hexachlorobenzene; heptachlor epoxide; and PCB 1260 in edible fish tissue. Although sections of the Walla Walla and its tributaries were identified as being impaired for other factors (including, but not restricted to: pH; dissolved oxygen; and temperature), this report addresses only chlorinated pesticides and PCB's.

Although parts of the Oregon side of the Walla Walla drainage appear on the 303(d) list as impaired for temperature, there are currently no listed impairments for toxins (Butcher, 2005 *pers. comm*.). However, it is important to note that in order to meet the most stringent toxin target loads it may be necessary to address activities taking place in Oregon with the help of state and local authorities at a later date. Toxin impairments in the Walla Walla River watershed that are addressed in this TMDL are summarized in Table 3.

In 2002-2003, Ecology conducted a TMDL evaluation of the chlorinated pesticide and PCB problem in the Walla Walla River and its tributaries. This study found several additional impairments previously not on the 1996 and 1998 303(d) lists. These are shown in Table 3 as 'unlisted but impaired'.

Table 3. Walla Walla Sub basin (WRIA 32) Toxics 303(d) Listings and Impairments.

Water Body	Waterbody ID#(old)	Waterbody ID#(new)	Parameter	Medium	Township Range Section	1996 List	1998 List	2002/ 2004 Proposed List	Unlisted But Impaired
Walla Walla River	WA-32-1010	QE90PI	4,4'-DDT	Tissue	07N 31E 25	No	No	Yes	
Walla Walla River	WA-32-1010	QE90PI	4,4'-DDE	Tissue	07N 31E 25	Yes	Yes	Yes	
Walla Walla River	WA-32-1010	QE90PI	Chlordane	Tissue	07N 31E 25	Yes	Yes	Yes	
Walla Walla River	WA-32-1010	QE90PI	Dieldrin	Tissue	07N 31E 25	Yes	Yes	Yes	
Walla Walla River	WA-32-1010	QE90PI	Heptachlor epoxide	Tissue	07N 31E 25	Yes	Yes	Yes	
Walla Walla River	WA-32-1010	QE90PI	Hexachloro-benzene	Tissue	07N 31E 26	Yes	Yes	Yes	
Walla Walla River	WA-32-1010	QE90PI	Total PCBs	Tissue	07N 31E 26	Yes	Yes	Yes	
Walla Walla River	WA-32-1010	QE90PI	4,4'-DDE	Tissue	07N 32E 35	No	No	Yes	

Water Body	Waterbody ID#(old)	Waterbody ID#(new)	Parameter	Medium	Township Range Section	1996 List	1998 List	2002/ 2004 Proposed List	Unlisted But Impaired
Garrison Creek		DH35GB	4,4'-DDT	Water	06N 35E 3	No	No	Yes	
Garrison Creek		DH35GB	4,4'-DDE	Water	06N 35E 3	No	No	Yes	
Garrison Creek		DH35GB	4,4'-DDD	Water	06N 35E 3	No	No	Yes	
Garrison Creek		DH35GB	Hexachloro-benzene	Water	06N 35E 3	No	No	Yes	
Walla Walla River		QE90PI	Toxaphene	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	4,4'-DDE	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	4,4'-DDD	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	Chlordane	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	Dieldrin	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	Heptachlor epoxide	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	Hexachloro-benze	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	PCBs	Tissue	07N 32E 21	No	No	No	X
Walla Walla River		QE90PI	4,4'-DDE	Water	07N 32E 36	No	No	No	X
Walla Walla River		QE90PI	Dieldrin	Water	07N 32E 36	No	No	No	X
Walla Walla River		QE90PI	Toxaphene	Water	07N 32E 36	No	No	No	X
Walla Walla River		QE90PI	PCBs	Water	07N 32E 36	No	No	No	X
Walla Walla River		QE90PI	4,4'-DDE	Tissue	07N 35 31	No	No	No	X
Walla Walla River		QE90PI	Dieldrin	Tissue	07N 35 31	No	No	No	X
Walla Walla River		QE90PI	Chlordane	Tissue	07N 35 31	No	No	No	X

Water Body	Waterbody ID#(old)	Waterbody ID#(new)	Parameter	Medium	Township Range Section	1996 List	1998 List	2002/ 2004 Proposed List	Unlisted But Impaired
Walla Walla River		QE90PI	PCBs	Tissue	07N 35 31	No	No	No	X
Walla Walla River		QE90PI	Toxaphene	Tissue	07N 35 31	No	No	No	X
Walla Walla River		QE90PI	4,4’-DDE	Water	07N 35E 31	No	No	No	X
Walla Walla River		QE90PI	4,4’-DDT	Water	07N 35E 31	No	No	No	X
Walla Walla River		QE90PI	Dieldrin	Water	07N 35E 31	No	No	No	X
Walla Walla River		QE90PI	PCBs	Water	07N 35E 31	No	No	No	X
Walla Walla River		QE90PI	Chlordane	Water	07N 35E 31	No	No	No	X
Dry Creek		OT03FJ	Dieldrin	Water	07N 34E 29	No	No	No	X
Dry Creek		OT03FJ	Hexachloro-benzene	Water	07N 34E 29	No	No	No	X
East Walla Walla River		XO26DW	4,4’-DDE	Water	06N 35E 38	No	No	No	X
East Walla Walla River		XO26DW	Dieldrin	Water	06N 35E 38	No	No	No	X
East Walla Walla River		XO26DW	Heptachlor epoxide	Water	06N 35E 38	No	No	No	X
Gardena Creek			t-DDT	Water	06N 33E 8	No	No	No	X
Garrison Creek		DH35GB	t-DDT	Water	06N 35E 3	No	No	No	X
Garrison Creek		DH35GB	Dieldrin	Water	06N 35E 3	No	No	No	X
Garrison Creek		DH35GB	PCBs	Water	06N 35E 3	No	No	No	X
Garrison Creek		DH35GB	Chlordane	Water	06N 35E 3	No	No	No	X
Mill Creek		SS77BG	t-DDT	Water	07N 35E 38	No	No	No	X
Mill Creek		SS77BG	4,4’-DDE	Water	07N 35E 38	No	No	No	X

Water Body	Waterbody ID#(old)	Waterbody ID#(new)	Parameter	Medium	Township Range Section	1996 List	1998 List	2002/ 2004 Proposed List	Unlisted But Impaired
Mill Creek		SS77BG	Dieldrin	Water	07N 35E 38	No	No	No	X
Mill Creek		SS77BG	Chlordane	Water	07N 35E 38	No	No	No	X
Mill Creek		SS77BG	PCBs	Water	07N 35E 38	No	No	No	X
Pine Creek		ZX47PC	Toxaphene	Water	06N 33E 1	No	No	No	X
Pine Creek		ZX47PC	4,4'-DDE	Water	06N 33E 1	No	No	No	X
Pine Creek		ZX47PC	4,4'-DDT	Water	06N 33E 1	No	No	No	X
Pine Creek		ZX47PC	Dieldrin	Water	06N 33E 1	No	No	No	X
Pine Creek		ZX47PC	Heptachlor epoxide	Water	06N 33E 1	No	No	No	X
Yellowhawk Creek		RK92TG	4,4'-DDE	Water	06N 35E 1	No	No	No	X
Yellowhawk Creek		RK92TG	4,4'-DDT	Water	06N 35E 1	No	No	No	X
Yellowhawk Creek		RK92TG	Dieldrin	Water	06N 35E 1	No	No	No	X
Yellowhawk Creek		RK92TG	PCBs	Water	06N 35E 1	No	No	No	X
Yellowhawk Creek		RK92TG	Chlordane	Water	06N 35E 1	No	No	No	X

Seasonal Variation

Ecology's TMDL evaluation of the Walla Walla watershed found a strong correlation between the levels of chlorinated pesticides and PCBs and sediment loads in the water column. The TMDL evaluation and historical data both show that the period of highest stream flow and sediment load is January to June, which coincides with the times of highest chlorinated pesticide and PCB concentrations. Both chlorinated pesticides and PCBs are well known for their propensity to bind strongly with soil particles. This and knowledge of the historical pesticide application in the area, leads to the conclusion that the primary source of these chemicals in the Walla Walla River and its tributaries was probably soil erosion.

The majority of soil erosion in the Walla Walla basin occurs from precipitation in winter through early spring, which is sustained though June from snowmelt (see figure 3). Infrequent storm events during winter months sometimes cause severe flooding from heavy rain and rapid snowmelt that can contribute the highest suspended sediments to the water column (Mapes, 1969).

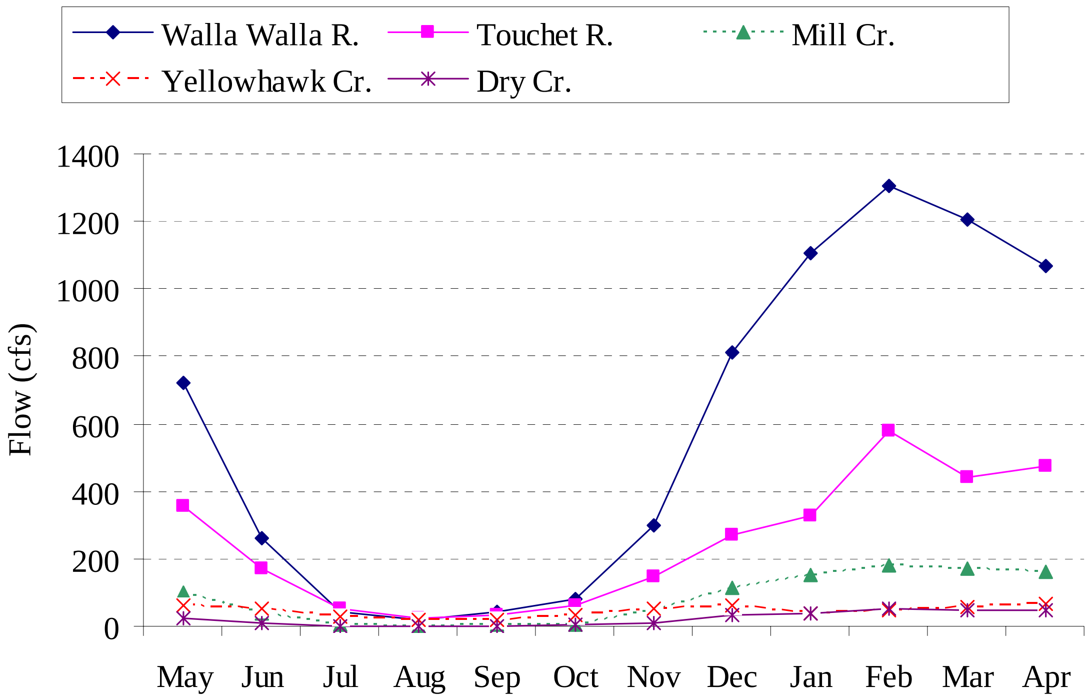

Figure 3. Typical flow patterns in the Walla Walla drainage (monthly averages from USGS data, 1951-2002 USGS gauge stations: 14018500; 14017500; 14015000; 14014000; 1401600).

Data collected in Ecology's TMDL evaluation showed marked seasonal variations in the level of pesticide/PCB contamination in the mainstem. The highest pesticide concentrations always coincided with high flow periods. Similarly the lowest concentrations almost always coincided with low flow periods. Runoff from agricultural land is highest during high flow periods which coincides with the high concentrations observed.

The highest PCB concentrations were similarly recorded during high flow months. Seasonal fluctuations in pesticide/PCB levels were also pronounced in the tributaries. Pesticides and PCBs increased substantially in the Walla Walla mainstem between the Oregon border and Detour Road. On average, concentrations increased by factors of two to four from the upper to middle river, with an eleven-fold increase for dieldrin. Except for toxaphene, concentrations generally decreased in the lower Walla Walla River (below Cummins Bridge). The reduced lower river concentrations are largely attributable to dilution by the Touchet River. The lower river averaged five times the toxaphene concentrations measured upstream.

Technical Analysis

This section summarizes the sampling and data analysis methods used in Ecology's 2002-2003 TMDL evaluation. Those seeking more detailed information should refer to the technical study (see Appendix A).

Sampling

Ecology's TMDL evaluation of chlorinated pesticides and PCBs in the Walla Walla drainage was based on water column, fish tissue, and wastewater treatment plant effluent sampling conducted from May 2002 to September 2003.

The purpose of the water sampling was to 1) identify possible or potential sources of contamination; 2) assess compliance with human health and aquatic life criteria; 3) test for relationships between chlorinated pesticides, TSS, and turbidity; and 4) calculate loadings to and within the river.

Concentrations of 303(d) listed pesticides and PCBs were sampled using semipermeable membrane devices (SPMDs) developed by the U.S. Geological Survey. A combination of laboratory calibration data and permeability/performance reference compounds (PRCs) spiked in deployed SPMDs were used in conjunction with field temperature to obtain an estimate of average concentrations.

An SPMD consists of a polyethylene tube filled with a lipid material called triolein. The rate at which SPMDs take up pesticides and PCBs has been determined in the laboratory. The rate varies with temperature, water flow, and the amount of biological growth on the membrane surface. Performance reference compounds (PRCs) are used to account for differences in these parameters between laboratory and field conditions. PRC compounds are spiked into an SPMD prior to deployment in a stream. The rate at which the PRCs are lost from the SPMD is proportional to the rate at which target compounds in the surrounding water are taken up by the SPMD. In other words, PRCs show how well the SPMD is performing compared to what was observed in the laboratory. The water column concentration determined from the SPMD is adjusted for the loss rate of the PRCs. A high rate of loss means the SPMD is sampling at a high rate, i.e., there is a high rate of movement of chemicals through the membrane. SPMDs provide a time-weighted average concentration for the chemicals of interest and measure only the dissolved ready bioavailable fraction. Ecology's study deployed SPMDs at ten sites (shown in Figure 4) on a quarterly basis for approximately one month each.

Deployments were timed to provide representative data over the range of runoff conditions that normally occur in the drainage. SPMD extracts were analyzed for the 303(d) listed pesticides and PCBs. This analysis was later expanded to include toxaphene, based on the examination of the chromatograms from the initial deployment in May. When chlorinated organic compounds are discharged to surface waters, they partition between dissolved and particulate fractions. Total pesticide/PCB concentrations in the Walla Walla drainage were mathematically estimated from the SPMD data. This is discussed in greater detail in *A Total Maximum Daily Load Evaluation for Chlorinated Pesticides and PCBs in the Walla Walla River* (see Appendix A).

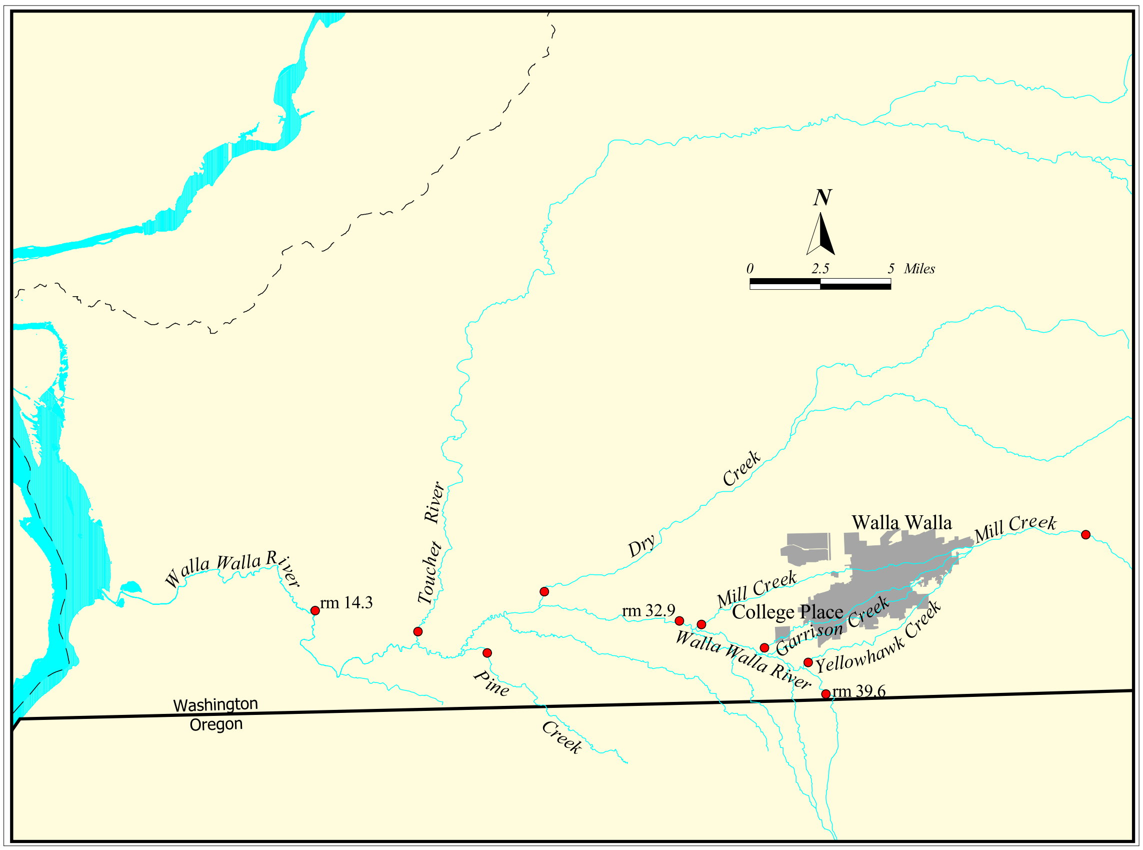

Figure 4. Water quality monitoring sites where SPMDs were deployed.

In addition to water sampling at the ten sites shown in Figure 4, wastewater treatment plants (WWTPs) at the cities of Walla Walla and College Place were evaluated separately as possible sources of chlorinated pesticides and PCBs. The Walla Walla plant discharges to Mill Creek and the College Place plant discharges to Garrison Creek (Figure 5). The other two WWTPs in the basin (Dayton and Waitsburg) are small discharges (< 1 million gallons per day) located over 40 miles up the Touchet River. As such, these plants are unlikely significant pesticide/PCB contributors to the Walla Walla River. Industries and other permitted facilities in the Walla Walla basin are not likely significant sources.

For the TMDL study, composite effluent samples were collected over a two-day period on a quarterly basis from the Walla Walla and College Place WWTPs. The locations of the effluent sampling sites are given in the TMDL technical report (see Appendix A). Sampling was done near the midpoint of the SPMD deployment period. Each sample was analyzed for chlorinated pesticides, PCBs, total suspended solids (TSS), and conductivity.

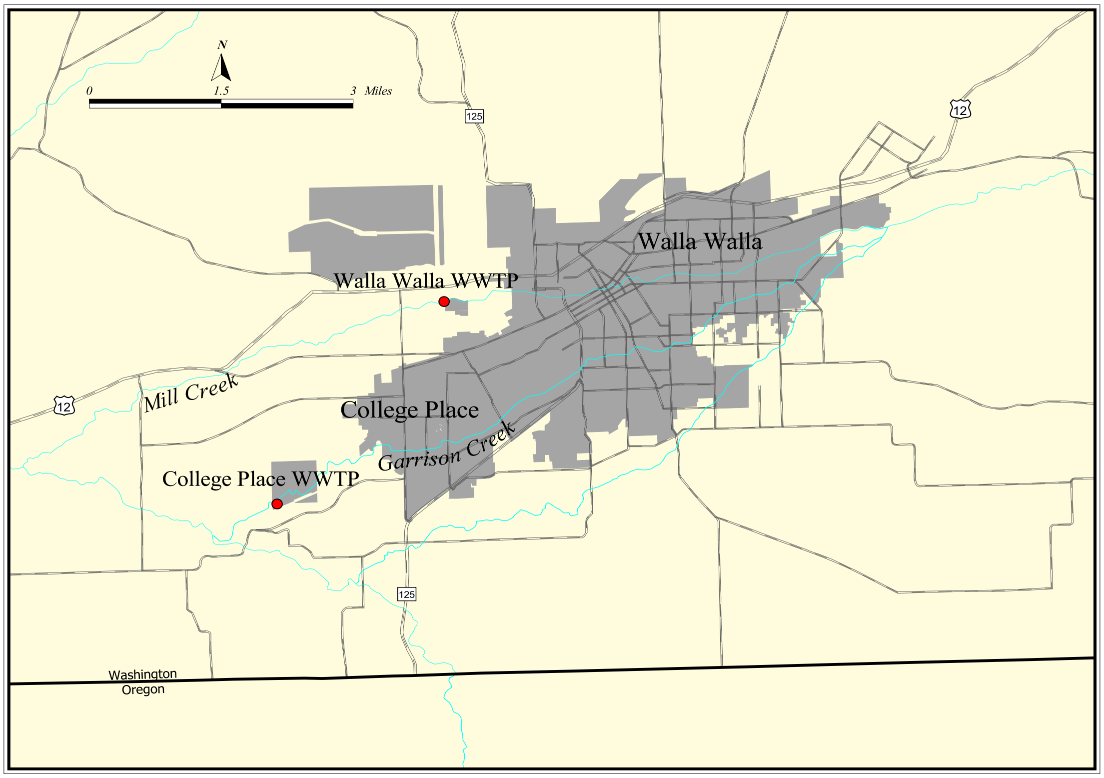

Figure 5. Location of Walla Walla and College Place WWTPs.

The purpose of collecting the fish tissue samples was to 1) determine the extent to which the pesticides and PCBs detected in 1992-93 continue to exceed 303(d) listing criteria, 2) assess appropriateness of applying EPA human health criteria to the Walla Walla River, and 3) provide data to the Washington Department of Health (WDOH) for a human health assessment. As noted previously, this analysis was limited to resident mainstem species, with upper river fish being analyzed separately from lower river fish using the Touchet River-Dry Creek reach as an approximate dividing line (Figure 6). The resident species most frequently consumed from the Walla Walla River are smallmouth bass (*Micropterus dolomieu*), channel catfish (*Ictalurus punctatus*), and carp (*Cyprinus carpio*). The fish tissue collection for the TMDL focused on these species. Some segments of the local population consume almost any fish they catch, therefore two other commonly encountered species, bridgelip suckers (*Catostomus columbianus*) and northern pike minnow (*Ptychocheilus oregonensis*; formerly known as northern squawfish) were also collected.

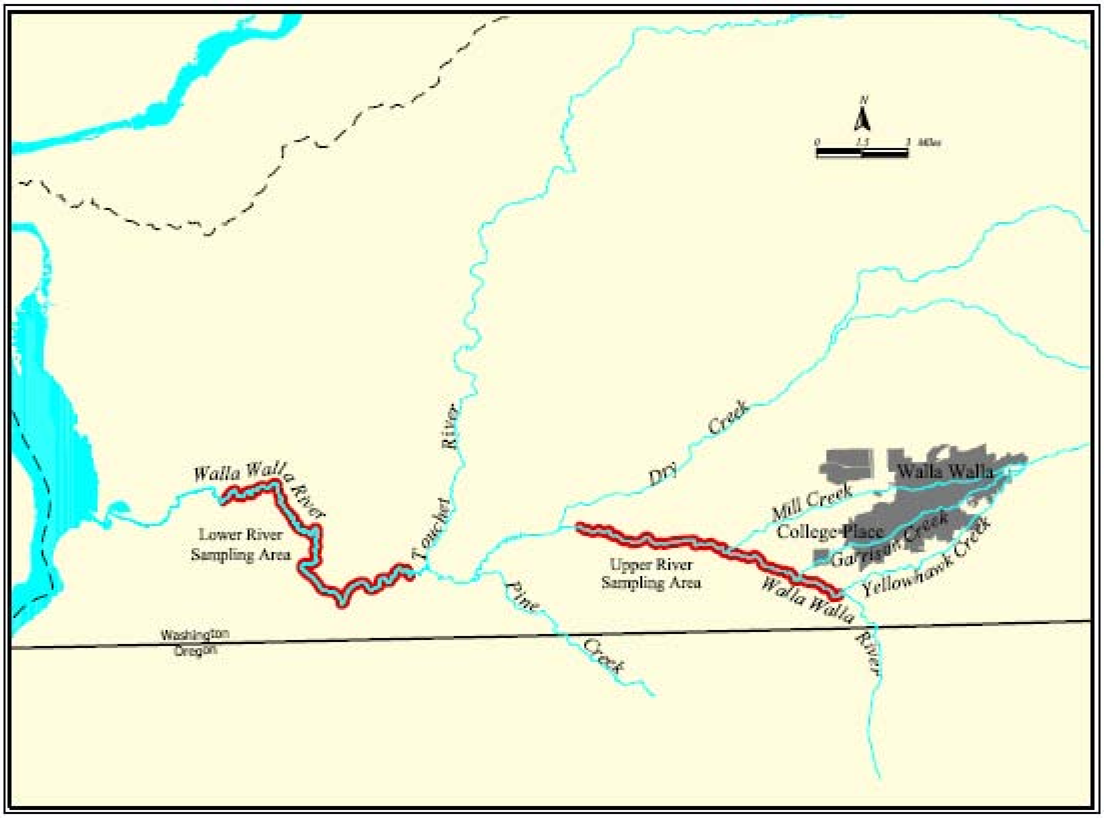

Figure 6. Location of fish samples.

Data on pesticides, PCBs, and other contaminants in migratory fish species that inhabit the Walla Walla River can be found in EPA's *Columbia River Basin Fish Contaminant Survey, 1996-1998* (2002b) or online at http://yosemite.epa.gov/r10/oea.nsf . The Touchet and nearby Dry Creek transport most of the sediment load discharged from the basin. Inputs of sediments and associated contaminants from these two tributaries, as well as Pine Creek, have the potential to result in substantially different water quality conditions in the lower river. Therefore, separate specimens for chemical analysis were obtained from the upper and lower river, using the Touchet River-Dry Creek reach as an approximate dividing line (see Figure 6). Samples close to the confluence with the Columbia River were avoided in an effort to obtain data representative of the Walla Walla River. The fish samples were collected in July and September 2002. Fillets were analyzed for 303(d) listed pesticides, PCBs (Aroclor-equivalents), and percent lipids.

Composite samples were used to obtain a cost efficient estimate of mean chemical concentrations. The target sample size was 20 fish of each species from each location, to be analyzed in composites of five fish each. At the request of the Confederated Tribes of the Umatilla Indian Reservation~~s~~ (CTUIR), several whole fish composites were included in the analysis.

Data Analysis

Historical application of chlorinated pesticides to soils and crops is the primary source of these chemicals in rivers and streams in agricultural areas like the Walla Walla basin (e.g., Risebrough and Jarman, 1984; Munn and Gruber, 1997). This reservoir of contamination is supplemented by current-day atmospheric deposition (e.g., Wania and Mackay, 1996). Once applied or air deposited, chlorinated pesticides bind to soil particles. The key to meeting pesticide standards in the Walla Walla River and its tributaries is to reduce the amount of soil entering these water bodies and maintain low TSS levels in the water column.

For chemical concentrations measured in the SPMD samples, pesticide concentrations in the Walla Walla drainage generally decreased in the following order: t-DDT (t = total) > t-chlordane > dieldrin >hexachlorobenzene > heptachlor epoxide. Toxaphene and PCBs were quantified less consistently than these other compounds, and concentrations were more variable. Upper Mill Creek and the upper Walla Walla River at the state line had the lowest concentrations of both pesticides and PCBs. The Touchet River also had a consistently low level of contamination relative to the Walla Walla River and other tributaries. On average, the highest t-DDT, t-chlordane, and dieldrin concentrations were found in Yellowhawk Creek, 3.7, 2.7, and 3.8 ng/L, respectively. Maximum t-DDT and dieldrin concentrations of 6.5 and 12 ng/L (parts per trillion) were recorded here. The maximum t-chlordane concentration however was in Garrison Creek at 6.4 ng/L. Dry Creek had the highest concentrations of hexachlorobenzene and heptachlor epoxide, averaging 1.5 and 0.6 ng/L. Large amounts of toxaphene were detected in Pine Creek, where concentrations up to approximately 40 ng/L were found. Creeks in the urbanized Mill Creek watershed had higher PCB concentrations than those that drained farming areas. The maximum t-PCB concentrations, 0.77 – 9.2 ng/L, were measured in Garrison Creek. Lower Mill Creek and Yellowhawk Creek had the second highest PCB levels, 0.54 – 1.1 ng/L for the two monitoring periods where PCBs were detected in these streams.

Regarding the fish tissue sampling, DDT compounds were present in the highest concentrations in the fillets, followed by PCBs/toxaphene, t-chlordane, dieldrin, hexachlorobenzene, and heptachlor epoxide, in that order. The relative amounts of these compounds generally mirrored what was found in the mainstem water column. The similar chemical profile among species suggests a common exposure history indicative of water quality conditions in the Walla Walla River. Average concentrations of t-DDT ranged from 30 – 657 ug/Kg (parts per billion). T-PCB and toxaphene concentrations averaged 8.9 – 238 ug/Kg and 16 – 56 ug/Kg, respectively. For most species, the average t-DDT concentrations were 105 ug/Kg or less, and the average PCB concentrations 48 ug/Kg or less. Total chlordane concentrations averaged 2.7 – 19 ug/Kg. Dieldrin, hexachlorobenzene, and heptachlor epoxide concentrations were 2.1ug/Kg or less. The highest pesticide/PCB concentrations were in carp, while the lowest were in smallmouth bass. Pesticide and PCB concentrations in whole suckers and pike minnow were typically two to three times higher than the average concentration found in fillets. For bass, the whole fish sample was five to ten times higher than fillets. This is usually interpreted as reflecting the higher lipid (fat) content in whole fish as chlorinated organic compounds are preferentially soluble in lipid.

The only compounds consistently detected in WWTP effluents were DDE, chlordane, and PCBs. Concentrations ranged from <0.066 – 0.11 ng/L for DDE, <0.066 – 0.20 ng/L for chlordane, and 0.53 – 2.5 ng/L for t-PCBs. Dieldrin was also detected in one or two samples from each plant at concentrations of 0.21 – 0.25 ng/L. The higher PCB and chlordane levels were found in College

Place effluent. Only PCBs were detected consistently in both plants, and the levels were not significantly different. DDE and dieldrin concentrations were similar in each effluent. Without further dilution, the average t-PCB concentration in the College Place and Walla Walla effluents would exceed the human health criterion of 0.17 ng/L by factors of approximately 7 and 5, respectively. The 0.14 ng/L dieldrin criterion was slightly exceeded at both plants, but by less than a factor of 2. Effluent concentrations of DDE, chlordane, and the other pesticides analyzed were always within human health criteria. For a full description of the results of Ecology's TMDL evaluation, refer to the TMDL technical report (Appendix A).

The National Research Council (2001) has suggested using statistical regression of a water quality indicator on one or more predictor variables as a simple and useful model for developing TMDLs. This study was able to correlate total DDT with TSS and set instream targets for TSS reduction to meet DDT criteria for aquatic life. TSS was, in turn, linked to the state turbidity standard and to fish habitat requirements. In the present study, pesticide, TSS, and turbidity data were obtained on 88 water samples from the Walla Walla drainage. These data were examined to determine how pesticide concentrations vary with TSS and turbidity. The analysis focused on 4,4'-DDE (a product of DDT breakdown) since this was the compound most consistently quantified in the samples. Other pesticides of concern are generally present at lower levels than DDE and exceed the limits of their criteria to a lesser degree. There was a strong positive correlation between DDE and TSS concentrations in all parts of the watershed. Land use changes directed at meeting DDE based target would also effectively address other problem pesticides identified in this report. However, because DDE occurs in association with its parent compound 4,4'-DDT and co-metabolite 4,4'-DDD, the target must be adjusted to account for the total amount of DDT compounds in the water column. The SPMD data show that the relative amounts of DDT, DDE, and DDD in the Walla Walla mainstem and tributaries are fairly constant, with DDE accounting for 50 ± 4 percent of the t-DDT (Figure 28). Therefore the DDE-based TSS target of 100 mg/L should be reduced to 50 mg/L to meet a t-DDT criterion (divide by a factor of 2). Additivity is appropriate since these compounds have the same or similar criteria and the same toxic endpoints and modes of action.

All four samples from the East Little Walla Walla River exceeded the DDE criterion at TSS concentrations between 6 - 38 mg/L (1 mg/L = 1 part/million), much lower than in other samples. DDT compounds, dieldrin, and heptachlor epoxide were all unusually high in the East Little Walla Walla, based on grab samples. DDE concentrations in Yellowhawk Creek were at or close to the criterion at TSS concentrations of 18 – 29 mg/L. Yellowhawk also had the highest t(total)-DDT, t-chlordane, and dieldrin concentrations in the SPMD samples. These results suggest DDT and other chlorinated pesticides were applied in these two watersheds at higher rates or for a longer period of time than elsewhere in the drainage. Since the other pesticides of concern are generally present at lower levels than DDE and exceed their criteria to a lesser degree, land use changes directed at meeting a DDE-based target would also effectively address these chemicals.

Turbidity is easier to monitor than TSS and because state standards for turbidity already exist, turbidity was selected as a surrogate measure of TSS where sampling *both* TSS and turbidity is not practical (Johnson, *pers comm*., 2005). The turbidity criteria are based on the relative change above background. For Class A waters (Chapter 173-201A-030-2 WAC): "Turbidity shall not exceed 5 NTU[1] over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background is more than 50 NTU." For this TMDL background, turbidity for the Walla Walla River was based on turbidity measurements taken at the state line and for Yellowhawk Creek background was based on measurement taken from Mill Creek at Seven Mile Road. State water quality standards allow that it may be necessary to use background conditions of a neighboring or similar watershed as the reference condition. Also turbidity at these sites was low most of the year during the 2002-2003 TMDL evaluation; therefore, it was reasonable to use these data.

The criteria do not set a maximum acceptable turbidity level based on beneficial use considerations, but they do limit the effect of an identified source on raising the turbidity in the receiving water.

Background conditions are further defined in Washington's water quality standards as ". . . the biological, chemical, and physical conditions of the water body, outside the area of influence of the discharge under consideration" except in headwaters where ". . . it may be necessary to use the background conditions of a neighboring or similar watershed . . ." (Chapter 173-201A-020 WAC).

There is no long-term record on background turbidities in the Walla Walla River that can be used for a comparison to standards. The historical TSS data indicate that violations of the Class A turbidity standard are routine in the lower river. The turbidity data obtained for the upper and lower Walla Walla River in the present study were compared to the turbidity equivalent to a 5 NTU increase over the upper river. These results show that the river was in violation of 5 NTU allowable increase during most of the winter and spring of 2002-2003 (65 percent of samples). In light of chronic violations of the turbidity standard and the link between turbidity and TSS, a regression equation was developed for these two parameters in the Walla Walla drainage. The resulting equation was Turbidity = 0.80 x $TSS^{0.87}$ (R^2 = 0.92). This equation was used to calculate turbidity levels that corresponded to the TSS targets for t-DDT.

Because of the difficulty in measuring low levels of PCBs in surface waters, TSS and turbidity targets could not be derived specifically for PCBs in the Walla Walla River and its tributaries. However, PCBs, like chlorinated pesticides, have a strong affinity for soil particles, so it is thought that meeting the TSS/turbidity targets in the Walla Walla drainage will also reduce PCB concentrations in the river and its tributaries. The water quality targets proposed for pesticides would also hopefully result in the state human health criterion for PCBs being met. For further details, please refer to the TMDL technical report (see Appendix A). The concentration of PCBs detected in the effluent of the Walla Walla and College Place WWTPs exceeded human health criteria (see *Applicable Criteria*) and therefore Garrison Creek and Mill Creek were assigned specific wasteload and load allocations for PCBs. These are discussed further in the wasteload and load allocation section of this document.

[1] nephelometric turbidity units

Loading Capacity

Loading capacity is the maximum amount of a pollutant that can be delivered to a water body and still achieve water quality standards. Loading capacity can be calculated by multiplying streamflow by the pollutant water quality standard. EPA recommends using the long-term harmonic mean flow for carcinogens, since the adverse impacts are realized over a lifetime of exposure (EPA, 1991). The harmonic mean is preferable to the arithmetic mean (the 'average') for analysis of sets of numbers which are defined in relation to some unit, for example, speed (distance per unit time). The arithmetic mean overstates the amount of dilution available over the long-term, and it is long-term fish consumption that is ultimately of most importance in meeting human health criteria. The harmonic mean is always less than the arithmetic mean.
The harmonic mean is calculated by dividing the number of values by the sum of the reciprocal of each value**.** For most rivers and streams, the harmonic mean is one-to- three times the 7-day, 10-year low-flow (EPA, 1991).

As an example, loading capacities were calculated for the Walla Walla mainstem using the harmonic mean. Table 4 shows estimates of the Walla Walla River's loading capacity for chlorinated pesticides and PCBs, based on the harmonic mean calculated from the flow record for the lower river (USGS gage near Touchet, 1951 – 2002). The loading capacity for chlorinated pesticides ranges from 0.012 – 0.070 grams/day (1 gram = 0.035 ounces). For PCBs, the loading capacity is 0.014 grams/day.

Table 4. Loading Capacity for Chlorinated Pesticides and PCBs in the Lower Walla Walla River (@ 34 cubic feet per second- harmonic mean flow).

Chemical	Human Health Water Quality Criteria (ng/L)	Loading Capacity (grams/day)
4,4'-DDT	0.59	0.049
4,4'-DDE	0.59	0.049
4,4'-DDD	0.84	0.070
t-DDT	0.59*	0.049
Chlordane	0.57	0.047
Dieldrin	0.14	0.012
Hexachlorobenzene	0.77	0.064
Heptachlor Epoxide	0.59	0.049
Toxaphene	0.2**	0.017
Total PCBs	0.17	0.014

* In the Walla Walla DDT, DDE, and DDD are interrelated in that DDE and DDD occur chiefly as a result of the breakdown of DDT. There are no human health criteria for t-DDT, but because the individual breakdown compounds have the same modes of action and toxic endpoints in humans, this TMDL applied the DDT and DDE human health criteria of 0.59 ng/L to t-DDT.
** In the case of toxaphene, the chronic freshwater aquatic life criteria were used instead of the human health criteria as this is the most stringent standard.

Loading capacities based on the harmonic mean are appropriate for situations where contaminant concentrations vary inversely with flow, as in the case of discharge of WWTP effluent to a river.

However, in the Walla Walla, the critical season for chlorinated pesticides, PCBs, and TSS is during the winter and spring when flows are elevated. Therefore, a different approach is needed to determine the loading capacity for TSS, which is being used as a surrogate water quality target in this TMDL**.** The 90th percentile high flow was used to assess loading capacity for TSS. The remaining ten percent was allocated for natural generation of sediment and turbidity. At the 90th percentile, TSS concentrations would be expected to exceed loading capacity no more than ten percent of the time. Estimated TSS loads during critical season, 90th percentile flows were compared to the loading capacity. The loading capacities at the TSS targets for the Walla Walla mainstem and the East Walla Walla River and Yellowhawk Creek are shown in Tables 5 and 6 respectively. **T**

Table 5. Loading capacities for the Walla Walla mainstem and tributaries (except for the East Little Walla Walla River and Yellowhawk Creek) at the 50mg/L and 30mg/L TSS targets.

Water Body	Loading Capacity (lbs/day)	
	@ 50mg/L TSS Target	@ 30 mg/L TSS Target
Upper Walla Walla R.	120,000	69,000
Lower Walla Walla R.	450,000	270,000
Garrison Creek	4,320	2,592
West Little Walla Walla	1,566	940
Mill Creek	47,790	28,674
Dry Creek	19,440	11,664
Mud Creek	1,620	972
Pine Creek	16,470	9,882
Touchet River	202,500	121,500
Gardena Creek	2,160	1,296

The data collected in Ecology's technical evaluation found higher pesticide concentrations in the East Little Walla Walla River and Yellowhawk Creeks than in the rest of the Walla Walla drainage. Therefore, more stringent TSS targets are deemed necessary to achieve compliance with state water quality standards (see the load allocation section).

Table 6. Loading Capacities for the East Little Walla Walla River and Yellowhawk Creek at the 30mg/L, 15mg/L and 5mg/L TSS targets.

Water Body	Loading Capacity (lbs/day)		
	@ 30 mg/L TSS Target	@ 15 mg/L TSS Target	@ 5 mg/L TSS Target
East Little Walla Walla	15,000	N/A*	380
Yellowhawk Creek	15,000	7,600	2,500

* The 15 mg/L TSS Target applies only to Yellowhawk Creek and is necessary to achieve compliance with Class A turbidity standards for the Mill Creek drainage.

The load reductions that appear to be needed in the mainstem lower river can be summarized in Table 7 as follows:

Table 7. Recommended load reductions in the mainstem Lower Walla Walla River.

Estimates of Loading Reductions Needed in the Mainstem Lower Walla Walla River To Meet Water Quality Targets and Goals for TSS			
Time Period	@ 50mg/L TSS Target	@ 30 mg/L TSS Target	@ 5 mg/L TSS Goal
January - June	74%	84%	97%
July - December	0%	20%	86%

Calculations indicate that no load reductions would be needed in Oregon in order for the Walla Walla River to meet either the 50 mg/L or 30 mg/L targets at the state line (see the load allocation section). TSS reductions on the Oregon side would be called for to attain a 5 mg/L goal. Under this goal scenario, very large TSS reductions would be needed basin-wide in both Washington and Oregon.

The Walla Walla and College Place wastewater treatment plants (WWTP) were evaluated as sources of chlorinated pesticides, PCBs, and TSS to Mill and Garrison creeks, respectively, where they discharge. The only compounds consistently detected in the final effluents were DDE, chlordane, and PCBs. Without further dilution, total PCB concentrations violated the human health criterion at both facilities. However, a comparison of loading estimates suggests that the WWTPs represent less than ten percent of the PCB load in the receiving waters and thus are not as important relative to nonpoint sources and background in these watersheds. Regardless these still represent point sources of PCBs; therefore, it is still necessary to set wasteload allocations for them in this TMDL. TSS concentrations in the effluents are limited through their NPDES permits. Discharge monitoring reports on file with Ecology show these facilities are not significant TSS sources.

Load and Wasteload Allocations

An initial TSS target of 50 mg/L is set to achieve compliance with Washington State human health criteria. The state's human health criteria for surface waters were issued to Washington by EPA in the National Toxics Rule (40CFR131.36). These criteria are the legally enforceable human health-based criteria used as control targets in TMDLs and other regulatory activities. In addition to the targets based on the human health-based criteria, this TMDL also provides water quality goals based on local fish consumption rates that can be used to inform future pollution control activities in the area. These goals address the higher risk/hazard that the tribes and other consumers incur as a result of their higher rates of fish consumption.

The secondary TSS target of 30 mg/L is set to achieve compliance with the state Class A turbidity standard in the Walla Walla River. Using an EPA approved procedure, a turbidity target of 15 NTU was calculated for the Walla Walla River downstream of the state line, which equates to a TSS target of 30mg/L.

The load/wasteload allocations established here-in for TSS/turbidity were designed to control the following parameters: 4,4’-DDT, 4,4’-DDE, Chlordane, Dieldrin, Heptachlorepoxide, Hexachlorobenzene.

Load Allocation

Load allocations, which include a margin of safety, are the nonpoint source reductions that need to be achieved in each segment of the river for the loading capacity to be met. In this TMDL evaluation, TSS is proposed as a surrogate measure for chlorinated pesticides. Equivalent targets are provided for turbidity. Achieving the TSS/turbidity targets should also address the PCB listings in the drainage, with the exception of Yellowhawk, Garrison, and Mill creeks for which separate load allocations are made.

This TMDL evaluation did not attempt to differentiate between TSS loading from nonpoint sources and background in Washington. Therefore, 100 percent of the TSS loading capacity is allocated to nonpoint sources and background. The load allocation for the lower Walla Walla River for the initial 50 mg/L target is 450,000 pounds per day. Nonpoint and background sources in Oregon contribute an unknown part of the TSS load to the East Little Walla Walla River, West Little Walla Walla River, Pine Creek, and Mud Creek via their upper watersheds. The entire TSS loading capacity of the Walla Walla River at the state line is allocated to nonpoint sources and background in Oregon. The river’s load allocation at the state line for the initial 50 mg/L TSS target is 120,000 pounds per day. The TSS target of 50mg/L corresponds to the state’s water quality standard (based on human health criteria) for a DDT concentration of 0.59 mg/L. The 30 mg/L target is based on meeting background turbidity for the water bodies. Table 8 shows the load allocations for the Walla Walla mainstem and its tributaries except for the East Little Walla Walla River and Yellowhawk Creek. Table 9 shows the load allocations for the East Little Walla Walla River and Yellowhawk Creek. Although these allocations will apply year round, Ecology’s technical study has identified January to June as the critical period for compliance. The remedial activities suggested in this report are focused on achieving compliance during the critical season, but they are expected to show improvements year round.

Table 8. Load allocations for the Walla Walla mainstem and tributaries, except for the East Little Walla Walla River and Yellowhawk Creek.
(Detailed sample site locations are given in the TMDL technical report, see Appendix A.)

Location	Load Allocation (lbs/day)	
	@ 50 mg/L TSS Target	@ 30 mg/L TSS Target
Upper Walla Walla R. @ Peppers Bridge	120,000	69,000
Lower Walla Walla R. @ Cummins Bridge	450,000	270,000
Garrison Creek	4,320	2,592
West Little Walla Walla	1,566	940
Mill Creek	47,790	28,674
Dry Creek	19,440	11,664
Mud Creek	1,620	972
Pine Creek	16,470	9,882

Location	Load Allocation (lbs/day)	
	@ 50 mg/L TSS Target	@ 30 mg/L TSS Target
Touchet River	202,500	121,500
Gardena Creek	2,160	1,296

Table 9. Load allocations for the East Little Walla Walla River and Yellowhawk Creek. (Detailed sample site locations are given in the TMDL technical report, see Appendix A.)

Location	Load Allocation (lbs/day)		
	@ 30 mg/L TSS Target	@ 15 mg/L TSS Target	@ 5 mg/L TSS Target
East Little Walla Walla River	15,000	N/A*	380
Yellowhawk	15,000	7,600	2,500

* The 15mg/L Target applies only to Yellowhawk Creek and is necessary to achieve compliance with Class A turbidity standards for the Mill Creek drainage.

Washington State's human health criteria for DDT compounds and other toxins are based on an average lifetime fish consumption rate of 6.5 grams per day. Since it is believed that most tribal members consume fish at higher rates than the average fish consumer, state standards may not be adequately protective of tribal members and other individuals with high rates of fish consumption. Table 10 shows fish consumption rates for Columbia River Intertribal Fish Commission (CRITFC) member tribes – Umatilla Confederated Tribes, Yakama Nation, Warm Springs Tribe, and Nez Perce Tribe as determined in a CRITFC (1994) fish consumption study.

Table 10. Fish Consumption Rates of CRITFC Member Tribes and Approximate Fish Meals per Month.

Population	Fish Consumption Rate (g/day)	Approximate Fish Meals Per Month**
General Public – average consumer	6.5*	1
Tribal Members – average consumer	63	8
General Public – high consumer	142	19
Tribal Members – high consumer	389	51

* Washington State standard
**assuming 8 ounces (roughly 227 grams) per fish meal and 30 days per month

In order to address tribes' concerns Ecology decided to add additional TSS goals that could be used in future pollution control activities to address the higher risk/hazard that the tribes and others incur as a result of their higher fish consumption rates. The EPA recently conducted a health risk assessment for people eating fish from the Columbia River basin (EPA, 2002). Using the values the EPA selected in that study, additional numerical TSS goals were developed to protect tribal members and members of the general public with high rates of fish consumption in the Walla Walla basin. Those seeking further detail on the EPA study and tribal members' consumption rates should refer to EPA 2002. Table 11 shows the t-DDT concentrations and their corresponding TSS targets and goals.

Table 11. TSS targets/goals and corresponding t-DDT concentrations for the protection of average and high fish consumers among the general public and tribal members.

TSS	Estimated Water Column t-DDT Concentration	Population Subgroup Addressed
50 mg/L Target	0.59 ng/L	**State Standard**: General Public –
30 mg/L Target	0.44 ng/L	**State Standard:** Turbidity*
5 mg/L Goal	0.059 ng/L	Tribal Members – average fish consumer
2 mg/L Goal	0.024 ng/L	General Public – high fish consumer
1 mg/L Goal	0.012 ng/L	Tribal Members – high fish consumer

* The turbidity target was based on the state turbidity standard for Class A water bodies (Chapter 173-201A-030-2 WAC).

Ecology's Walla Walla TMDL technical study found that monitoring data indicated an additional TSS target needed to be set for meeting the Class A turbidity standard in the Walla Walla River. Using an EPA approved procedure for the lower Yakima River TMDL, a turbidity target of 15 NTU was calculated for the Walla Walla River downstream of the state line, which equates to a TSS target of 30mg/L. The 30 mg/L target was added to the other TSS targets to ensure compliance with state turbidity standards. For further details on the derivation of the turbidity target and the regression equation used to calculate the corresponding TSS target refer to Ecology's Walla Walla chlorinated pesticides and PCBs TMDL technical study (Appendix A).

As shown, the approach adopted in this TMDL was specifically designed to not only meet the load allocations that address state toxicity standards, but also to address state turbidity standards. Additional goals are provided in the study that can be used to inform the development of future water quality targets that specifically address high fish consumers in the Walla Walla basin. Table 12 summarizes the calculated numerical water quality targets and goals for the Walla Walla River drainage - except for the East Little Walla Walla River and Yellowhawk Creek.

Table 12. Water quality targets for the Walla Walla River drainage. (Excluding the East Walla Walla River and Yellowhawk Creek.)

TSS	Turbidity Target	Effect of Meeting the Target
50 mg/L Target	24 NTU	• achieves compliance with human health water quality criteria for chlorinated pesticides • addresses average fish consumers among the general public • provides a moderate level of habitat protection
30 mg/L Target	15 NTU	• achieves compliance with the Class A turbidity standard
5 mg/L Goal	3 NTU	• addresses average tribal fish consumers • provides a high level of habitat protection
2 mg/L Goal	1 NTU	• addresses high fish consumers among the general public
1 mg/L Goal	<1 NTU	• addresses high fish consumers among tribal members

The same approach used for the Walla Walla mainstem was used for the East Walla Walla River and Yellowhawk Creek. However, more stringent TSS/turbidity targets are recommended for the East Walla Walla River and Yellowhawk Creek specifically, because higher concentrations of the chemicals addressed in this report are found here relative to the rest of the Walla Walla drainage. Therefore, the 50mg/L TSS target employed for the Walla Walla mainstem is deemed not to be protective enough of water quality standards for these water bodies. The 30 mg/L TSS target is still applicable as it is necessary to ensure protection of state turbidity standards. However a more restrictive target is needed for Yellowhawk Creek to meet turbidity standards. Present survey data show that turbidity in Yellowhawk Creek should be at or below 8 NTU, which equates to a TSS concentration of 15mg/L.

A TSS 5 mg/L: 3 NTU turbidity target for the East Little Walla Walla River and Yellowhawk Creek should protect average fish consumers among the general public. The data collected indicate that TSS/turbidity levels that would address higher rates of fish consumption among the general public and tribal consumers approach zero for these two water bodies and so are not proposed as goals at this time. This effort would best be initiated after some water quality improvements have been realized, at which point the relationship between TSS, turbidity, and trace-level pesticide contamination may be more easily and accurately discerned. Those seeking more detail on how NTU and TSS targets were calculated for the East Walla Walla River and Yellowhawk Creek should refer to Ecology's Walla Walla TMDL technical study (Appendix A). Table 13 shows water quality targets recommended specifically for the East Little Walla Walla River and Yellowhawk Creek.

Table 13. Water Quality Targets for the East Walla Walla River and Yellowhawk Creek.

TSS	Turbidity Target	Effect of Meeting the Target
5 mg/L Target	3 NTU	• achieves compliance with human health water quality criteria for chlorinated pesticides • addresses average fish consumers among the general public • provides a high level of habitat protection
30 mg/L Target	15 NTU	• achieves compliance with the Class A turbidity standard (for mainstem Walla Walla) • provides a moderate level of habitat protection
15 mg/L Target (Yellowhawk Creek)	8 NTU (Yellowhawk Creek)	• achieves compliance with the Class A turbidity standard (for Mill Creek drainage)
Goals to protect consumers with high rates of fish consumption among the general public and tribe to be developed at a later date.		

In order to meet the water quality standards at issue in this TMDL, it is recommended that the targets be applied to the Walla Walla River at the state line and at the mouths of all mainstem tributaries in Washington. Each tributary is a natural water body with fisheries and aesthetic resource values deserving of protection, and the targets protect these values.

A phased approach should be adopted for meeting the targets, starting with the 30 mg/L:15 NTU target in the East Little Walla Walla River and Yellowhawk Creek and the 50 mg/L:24 NTU target in other parts of the drainage. The 50 mg/L:24 NTU target is overprotective for chlorinated pesticides in the Touchet River. The target retains its value for habitat protection and meeting the turbidity standard nonetheless. For the East Little Walla Walla River and Yellowhawk Creek, the ultimate 5 mg/L:3 NTU target is overprotective for habitat and turbidity, but appears necessary to meet pesticide standards. Initially, the targets should be applied directly to all irrigation returns and other potential or probable sources at the point they enter the mainstem or tributaries. This is the simplest and most equitable approach. The focus of remedial actions in this TMDL is largely on agricultural lands because firstly, most land use in the Walla Walla Basin is agricultural, and secondly, the chemicals addressed in this TMDL have historically been applied primarily in agricultural areas. In addition, it is impractical to set water quality targets tailored for each individual return. Monitoring data from the tributaries coupled with knowing where BMPs are and are not being implemented can guide later sampling efforts for irrigation returns. Once water quality improvements become realized and TSS/turbidity targets are progressively achieved, it may be appropriate to develop different targets for the returns.

The 2 mg/L:1 NTU and 1 mg/L:<1 NTU goals imply exceptional water quality conditions and would be difficult to achieve in an agricultural basin like the Walla Walla. Because they were extrapolated to equate to t-DDT concentrations below the detection limit, there is a substantial amount of uncertainty in their accuracy. Once erosion and TSS levels are reduced, sediments may possibly carry a lower amount of pesticides and so the goals (based on the current relationship be pesticides and TSS) may have to be reevaluated as shown in the Yakima toxin TMDL. The appropriateness of these values should be re-assessed once the more easily achieved targets are met.

Wasteload Allocation

Wasteload allocations are point source reductions needed in each segment of the river for the loading capacity to be met. This TMDL evaluation did not attempt to differentiate between TSS loading from point sources, nonpoint sources, and background in Oregon. No significant TSS point sources to the Walla Walla River are present or anticipated in Oregon. Therefore, wasteload allocations are zero.

No significant point sources of TSS are present or anticipated in the Washington portion of the Walla Walla watershed. Wasteload allocations are therefore zero here as well, with the exception of the Walla Walla and College Place WWTPs. National Pollutant Discharge Elimination System (NPDES) permits limit the amount of TSS that can be discharged by the College Place and Walla Walla WWTPs (wastewater treatment plants). The current limits state that the average monthly effluent concentrations for TSS “shall not exceed 15 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.” Discharge monitoring reports on file with Ecology show that the Walla Walla and College Place WWTPs are insignificant sources of TSS to the receiving waters. Adjustments to the NPDES permits for these WWTPs are not necessary at this time, and TSS allocations should be consistent with permit load limits.

Wasteload and load allocations were assigned for PCBs in Garrison Creek and Mill Creek in light of the levels detected in the College Place and Walla Walla WWTP effluents. The wasteload allocations for PCBs identified in this report shall be added to the NPDES permits for the WWTPs of Walla Walla and College Place once the TMDL detailed implementation plan (DIP) is completed. Nonpoint sources coming into the WWTPs may be contributing to elevated PCB levels found in the WWTP effluent. Future remedial actions directed at nonpoint sources may help to alleviate the PCB problem in the WWTP’s discharge. The WWTP wasteload allocations were calculated as the product of the human health water quality criterion and the NPDES permit limit for the average monthly effluent flow. The remaining loading capacity of these streams was allocated to nonpoint sources. (There is no natural background for PCBs.) In addition to Mill and Garrison creeks, Yellowhawk Creek was also found to be impaired for PCBs and was therefore assigned a load allocation. However, because no point source has yet been identified in this tributary, no wasteload allocation for PCBs has been assigned. Further monitoring is needed to determine what (if any) point sources of PCBs exist on Yellowhawk Creek. If point sources are identified, they should be addressed through future NPDES or stormwater permits. The PCB wasteload and load allocations for Garrison Creek and Mill Creek, and the load allocation for Yellowhawk Creek are shown in Table 14 below.

Table 14 Wasteload and Load allocations for PCBs in Garrison Creek, Mill Creek, and Yellowhawk Creek.

Wasteload and load allocations for PCBs (gm/day)	Garrison Creek	Mill Creek	Yellowhawk Creek
Wasteload allocation for WWTP	0.0011	0.0062	
Load allocation for nonpoint	0.0017	0.023	0.010
Loading capacity	0.0028	0.029	0.010

It is recommended that the Walla Walla and College Place WWTPs work closely with Ecology to develop practical and cost effective management plans to reduce PCB concentrations in their effluent. These plans should be professionally designed and include a detailed monitoring and management strategy for determining the sources of PCB contaminate in the WWTPs' service area and identifying possible remedial actions such as pretreatment and/or re-use. In addition, such plans should include detailed WWTP effluent monitoring to assess whether implementation is successful. Through consultation with Ecology, it should be possible to set interim wasteload targets and determine an appropriate and cost effective effluent sampling strategy. Ecology will give technical and financial assistance wherever possible, to ensure the remedial strategies are effective in reducing PCB levels in accordance with the wasteload allocations assigned in this TMDL.

It is probable that urban stormwater runoff is an additional contributing source of chlorinated pesticides and PCBs in the basin. Although the sources of PCB impairment in Yellowhawk Creek have as yet not been identified, it is possible that stormwater runoff from the city of Walla Walla may be contributing to the problem. Because stormwater runoff was not specifically studied in Ecology's chlorinated pesticide and PCB TMDL evaluation study, sufficient data are not available with which to set allocations for stormwater runoff at this time. The detailed implementation plan (DIP) for this TMDL will include a monitoring plan that may help determine future stormwater allocations, and will identify those corrective measures necessary to address chlorinated pesticides and PCBs in storm water. Until data are available, Walla Walla County, Columbia County, and the cities of Walla Walla and College Place, should develop and implement programmatic activities to control sediment concentrations in their stormwater runoff. Specifically, it is recommended they adopt ordinances or other regulatory mechanisms to require stormwater runoff controls at construction sites and post-construction stormwater controls for development projects, train staff to review development site plans and perform site inspections, and adopt an operation and maintenance plan that incorporates practices to reduce suspended solids in runoff from their municipal operations.

These jurisdictions should refer to the *Stormwater Management Manual for Eastern Washington* (2004) and *Model Municipal Stormwater Program for Eastern Washington* (2003) and review their current stormwater management ordinances and municipal practices to determine whether they are adequately protective of surface water quality (see Appendix C and D). Where enhanced stormwater quality management needs are identified, specific recommendations will be provided by Ecology. These jurisdictions must also carry out any legally mandated responsibilities with regard to stormwater management, including adherence to the requirements of any future NPDES Permits issued to them. Moreover, they may possibly be required to seek coverage under the Eastern Washington Phase II NPDES Permit for Municipal Stormwater Discharges. Stormwater permit holders should be in compliance with applicable quality assurance project plan (QAPP) as part of such compliance. Furthermore the permit holders may be required to submit a TMDL summary implementation report detailing the status and actions taken by the permit holder to implement the TMDL.

Margin of Safety

A margin of safety is required in a TMDL to account for uncertainty in understanding the relationship between pollutant discharges and water quality impacts. This TMDL evaluation incorporates several procedures and assumptions that confer a safety margin.

- Two methods were used to derive the TSS concentration on which the water quality targets were based, thereby increasing confidence in the appropriateness of the targets.
- The additive effects from the combined concentrations of DDT, DDE, and DDD were accounted for by basing the water quality targets on t-DDT. Basing targets on t-DDT rather than DDE, DDE, and DDT individually is more protective of water quality than what strict adherence to the individual criteria calls for.
- Although it was not feasible to set PCB allocations for all tributaries, a loading capacity for PCBs in the Walla Walla River was based on a conservative assumption for calculating flow (harmonic mean). The harmonic mean is preferable to the arithmetic mean here as the arithmetic mean overstates the amount of dilution available over the long-term, and it is long-term fish consumption that is ultimately of most importance in meeting human health criteria.
- A watershed drainage area approach to load and wasteload allocation should be protective of individual tributaries.
- A t-DDT target provides a wider margin of safety for other chlorinated pesticides, since these are generally present at lower concentrations relative to criteria.
- Ecology's TMDL evaluation found the levels of chlorinated pesticides, PCBs, and total suspended solids in the Walla Walla River are highest during winter and spring when the runoff is highest. Therefore, the loading capacity was calculated based on flows during this period, rather than the period of lowest flow as is often the case. In this way, the loading capacity set in this report should be most protective of water quality in the drainage.
- The 90th percentile statistic was used in developing the turbidity target and assessing loading capacity. This approach implicitly allocates ten percent of the load to natural generation of suspended sediment and turbidity.
- The recommended approach of applying the water quality targets directly to tributaries and drains gives a wider margin of safety than requiring only the minimal water quality improvements needed to meet standards in the mainstem.
- A phased approach for implementing the targets/goals is proposed; the ultimate targets/goals are conservative.
- Washington State water quality criteria have large margins of safety built into them. Also, Washington State uses the highest risk level (one in a million excess lifetime cancer risk) to apply to National Toxic Rule Criteria.

Several sources of uncertainty could not be resolved with the information currently available.

- Because of difficulties in analyzing trace amounts of PCBs in surface water and a lack of information on sources, it is uncertain exactly how the decrease in PCB concentrations will track with the proposed water quality targets and at what point in the cleanup process standards will be achieved.
- As already described, there is uncertainty in the accuracy of the 2 mg/L:1 NTU and 1 mg/L:<1 NTU water quality goals, and the appropriateness of these values should be reassessed once the more easily achieved targets are met.
- Because estimated toxaphene concentrations exceeded t-DDT levels in Pine Creek, meeting water quality targets for TSS in this creek may not result in toxaphene meeting standards. Source investigation is recommended.

Finally, this study did not investigate the bottom sediments in the Columbia River backwater formed in the lower ten miles of the Walla Walla River by McNary Dam. This area is a likely sink for chlorinated pesticides and PCBs associated with particulates transported by the Walla Walla River and a potential source of contamination to fish. Sediment recovery will occur as upstream water quality targets are met, but the time for recovery is unknown.

Summary Implementation Strategy

Introduction

A summary implementation strategy (SIS) is needed to meet the requirements of a TMDL submittal for approval as outlined in the 1997 Memorandum of Agreement between the U.S. Environmental Protection Agency and the Washington State Department of Ecology. Its purpose is to present a clear, concise, and sequential concept of how the waters covered in the TMDL will achieve water quality standards. The SIS includes an outline of how a more detailed implementation plan will be developed, those implementation activities that are planned or already underway, a strategy for developing follow-up monitoring plans, a summary of public involvement methods, and potential funding needs and sources to make implementation of the plan a reality.

A TMDL advisory group was formed in early 2005 to guide the development of this report. At the time of writing this report, groups currently represented in the advisory group include: the Walla Walla County Watershed Planning Unit, Gardena Farms Irrigation District; Walla Walla Watershed Alliance; Whitman College; Walla Walla Community College; Walla Walla County Planning Commission; the Walla Walla County Health Department; Confederated Tribes of the Umatilla Indian Reservation~~s~~; Kooskoskie Commons; Washington State University Cooperative Extension program; city of College Place; and city of Walla Walla. The rest of the advisory group is made up of local private landowners representing a variety of interests from across the basin.

There are several other important organizations working in the Walla Walla region that are currently not serving on the advisory group but their assistance in the development of this TMDL is appreciated. These groups include Washington Department of Fish and Wildlife, Walla Walla County Conservation District, Columbia Conservation District, and the Natural Resource Conservation Service. Efforts have been made to encourage representatives of these groups to serve at future advisory group meetings. In addition, representatives from the Oregon Department of Environmental Quality and the Oregon based Walla Walla Watershed Basin Council have been contacted and encouraged to attend future advisory group meetings to foster cross-border relations and to ensure coordination of implementation activities across administrative boundaries. It is proposed that representatives from these groups will not serve as official advisory group members because of jurisdictional conflicts. There is currently a high level of cooperation and communication between advisory group participants, and their continued participation in the TMDL process and assistance in later implementation phases of the project is appreciated.

Implementation Overview

The strategy to implement the TMDL is based upon the continuation of the many existing efforts already underway throughout the watershed to reduce suspended sediment in project area waterways. Point sources will be addressed by adherence to discharge limits set in Ecology's NPDES permits. The nonpoint sources (load allocations) will be addressed by the use of BMPs and education. The principal focus of the TMDL will be to continue the implementation of seasonal and year-round BMPs to prevent the entry of sediment into area water bodies.

Additionally, continued monitoring of implementation activities and water quality is essential in assessing the progress of the TMDL.

The goal of this TMDL is to reduce chlorinated pesticides and PCBs in the Walla Walla River and its tributaries so that levels meet water quality standards. Table 15 shows the recommended interim and final timelines for the achievement of water quality targets/goals set in this report. The timelines shown are meant to represent number of years after completion of the detailed implementation plan (DIP).

Table 15. Timelines for the achievement of interim targets and state water quality standards

Number of Years from end of DIP	Walla Walla River Mainstem		East Walla Walla and Yellowhawk	
	TSS Target/Goal	Turbidity Target/Goal	TSS Target	Turbidity Target
5	50mg/L	24 NTU	30mg/L	15 NTU
10	30mg/L	15 NTU	15mg/L	8 NTU
15	5mg/L	3 NTU	5mg/L	3 NTU
20	2mg/L-1mg/L	1 to < 1 NTU	<5mg/L: developed later	

A detailed implementation plan (DIP) will be prepared within a year following EPA's approval of the TMDL submittal report. Continued workgroup support and additional public input will be sought to help prepare this plan. The DIP will identify specifically how, when, and where voluntary restoration activities will be implemented. A detailed monitoring plan will also be developed. Ecology and other entities will provide technical assistance and seek additional funding for these restoration activities and monitoring.

Implementation Activities

This report acknowledges and is appreciative of the many federal, state, local governmental, and non-governmental agencies that have already sponsored or implemented a variety of conservation activities that may have helped to partially alleviate the toxin problem addressed in this TMDL. However, the results of Ecology's TMDL evaluation indicate that further action is needed if state water quality standards are to be met. To this end, it is necessary to identify available resources and devise future implementation actions. Also, an effectiveness monitoring strategy needs to be planned as a key component of an adaptive management process essential to a successful TMDL. This section will discuss these issues in detail.

As stated earlier, Ecology's TMDL evaluation of chlorinated pesticides and PCBs in the Walla Walla River concluded that a reduction of total suspended solids (TSS) in the water column was key to meeting water quality targets for these chemicals. A recent report by Economic and Engineering Services, Inc.(EES, 2003) identified a number of sources of sediment including road-building and logging activities in the upper reaches of tributaries, recreational vehicle use, and urban runoff. They concluded, however, that "given the predominance of agricultural land use in the watershed, agricultural practices have been identified as the principal source of fine sediment," a conclusion supported by Ecology's TMDL evaluation.

The preliminary draft of the Walla Walla Watershed Plan, January 2005 (Appendix B) shows a table of suggested management actions. Many of these actions would serve to reduce the TSS levels of toxins addressed in this TMDL and are reproduced here (Table 16).

Table 16. Summary of management goals for the Walla Walla chlorinated pesticides and PCBs TMDL.

Management Category	Project Type
1. Prevent/Mitigate Forest Practices Impacts Activities on forested lands can have significant impacts on water quality, particularly as they relate to forest practices, soil erosion and water temperature. Protection of forested headwater drainages is critical as a source of high quality water for downstream reaches, which support a variety of beneficial uses	
1a. Improve Forest Road/Trail Management	• Management of forest roads • Design of forest roads/culverts • Construction practices for forest roads • Erosion control for forest roads • Decommissioning of forest roads/trails • Road fill evaluation • Road density evaluation
1b. Improve timber Harvest Management	• Evaluation of unstable slopes • Timber harvest management plans • Road and timber harvest buffers • Restoration of riparian recreation areas • Soil compaction mitigation
1c. Other Watershed Actions	• Watershed assessments • Coordinated resource management plans • Water quality monitoring
1. Prevent/Mitigate Agricultural Impacts Nonpoint chlorinated pesticide and PCB sources are varied in the Walla Walla, but are primarily related to historically applied agricultural chemicals. Ongoing efforts by the Washington State Dept. of Ecology working with the Conservation Districts, NRCS, Irrigation Districts, and local water users to reduce nonpoint source impacts are already successfully addressing some of these problems.	
2a. Improve Irrigation Water Management	• Irrigation district system improvement • Irrigation scheduling and management • On-farm irrigation system Upgrades/conversion • On-farm sediment ponds • Off-farm sediment ponds
2b. Improve Cropland Management	• In-furrow residue placement • Row crop erosion control • Tillage management
2c. Reduce Impacts of Agricultural Chemicals	• Pesticide application training • Pesticide licensing programs • Row crop soil erosion controls • Irrigation water management • Deep percolation evaluations
2d. Address Livestock Impacts	• Maintain Technical/Financial Support to Confined Animal Feeding

Management Category	Project Type
	Operations (CAFO); NPDES Permitting of CAFOS • Voluntary fencing of streams and buffer strips near streams • Small landowner assistance programs • Application of public land grazing programs • Manure management • Support conservation district efforts regarding dairies
2e. Control Other Agricultural Impacts	• Roadside spraying evaluations • Aquatic weed control evaluations • Silt removal from canals/laterals • Canal weed control impacts • Pesticide residue monitoring in aquatic life • Agricultural soil monitoring for pesticides • Educational and assistance programs for small farm/ranches • Educational tours/demonstrations for commercial growers • Consider water quality impacts in routine operations and maintenance of irrigation canals
2. Prevent/Mitigate Stormwater Impacts Stormwater runoff from developed and urban areas and industrial sites contains pollutants that impact receiving waters. State and regional guidelines exist (e.g., Eastern Washington's Stormwater Guidelines) to identify appropriate stormwater management practices. Stormwater ordinances have been adopted by county governments and other municipalities in the Walla Walla River Basin.	
3a. Plan/Implement Municipal Stormwater Runoff Controls	• Municipal stormwater ordinances • Regional stormwater runoff control guidelines • Municipal stormwater control plans • Regional stormwater impact assessments • Urban/suburban land use awareness programs transportation/de-icing guidelines
3b. Plan/Implement Industrial Stormwater Runoff Control	• Industrial stormwater ordinances • Regional industrial stormwater guidelines • Industrial stormwater control plans • Regional stormwater impact assessments

Most forestry operations are likely to occur on lands on the Oregon side of the Walla Walla drainage and are thus beyond the jurisdiction of the Washington State Department of Ecology. Ecology's TMDL evaluation concluded that activities on the Oregon side of the border were relatively minor contributors to the toxin problem in the Walla Wall basin. However, it may still be necessary to address these Oregon sources in order to meet the most stringent TMDL water quality targets/goals. It is anticipated that existing programs under the state's forest and fish regulations, DNR's Habitat Conservation Plan (HCP), and the federal government's Northwest Forest Plan will provide the regulatory framework needed in this regard.

There has been considerable attention in recent years to reducing water quality impacts from agriculture on the region's waterways. Existing permit programs and voluntary measures to address water quality concerns should continue to be used. Advisory agencies such as the Washington State University (WSU) Cooperative Extension, the Walla Walla County Conservation District, and the Columbia Conservation District are available to offer technical and financial assistance with landowners' efforts. The Walla Walla Watershed Plan suggests that total sediment loading can be reduced by 85 percent by using no-till practices instead of historical cropping practices involving significant tillage operations. This plan recommends that planning decisions be focused toward land practices that decrease susceptibility to erosion during the critical period of January to June.

Because stormwater runoff was not specifically studied in Ecology's chlorinated pesticide and PCB TMDL evaluation study, sufficient data are not available with which to set allocations for stormwater runoff at this time. Until data are available, Walla Walla County, Columbia County, and the cities of Walla Walla and College Place must carry out any legally mandated responsibilities with regard to stormwater management, including adherence to the requirements of any future NPDES permits issued to them. These jurisdictions should refer to the *Stormwater Management Manual for Eastern Washington* (2004) and *Model Municipal Stormwater Program for Eastern Washington* (2003) and review their stormwater management ordinances and municipal practices to determine whether they are adequately protective of surface water quality (see Appendix C and D respectively). Where enhanced stormwater quality management needs are identified, specific recommendations will be provided by Ecology, possibly including a requirement to seek coverage under the Eastern Washington Phase II NPDES Permit for Municipal Stormwater Discharges.

Because urban and suburban household materials are potential sources of nonpoint pollution, educational programs focused on the proper use and disposal of household hazardous materials should be advertised and offered to the public. These programs should increase urban and suburban residents' awareness about how household hazardous materials should be used and the implications of misuse. Household hazardous materials are herbicides, pesticides, and cleaning agents, as well as automotive and light industrial fluids that are commonly present in the home or on a farm.

Table 17 lists the possible entities that may use the general implementation actions to meet the targets in this TMDL. The information listed in the table is part of an overall strategy and will likely change as personnel and monetary resources are better defined during the development of the DIP.

*Note: Please refer to the list of acronyms and abbreviations (**Appendix G**) for further assistance with **Table 17.***

Table 17. Organization of TMDL entities and their contributions.

Entity	Responsibilities to be met
TMDL advisory group	Review progress of implementation strategy
Ecology	Manage the TMDL process, provide guidance and support to other agencies
Homeowners with waterfront property	Avoid actions that will cause streambank destabilization or erosion or will otherwise add sediment to area waterways
Irrigation Entities (Districts and Companies)	Where possible improve irrigation efficiencies, upgrade diversions and, where appropriate, implement BMPs to prevent entry of suspended sediment into area waterways
Irrigators	Implement appropriate BMPs to prevent entry of sediment-laden agricultural return flows into area waterways
Columbia Conservation District (CCD) and Walla Walla County Conservation District (WWCCD) and Ecology	Continue to fund agricultural BMP implementation: controlling agricultural runoff, reducing suspended sediment in drains and tributaries, preventing streambank destabilization and erosion.
CCD, WWCCD, WSU Cooperative Extension, Kooskooskie Commons	Extend outreach efforts and technical assistance to agricultural producers (irrigators, livestock managers, others) in the watershed
CCD and WWCCD	Continue to monitor water quality of the watershed's surface water (as possible, given funding availability)
Walla Walla and Columbia County governments, and Walla Walla, College Place, Waitsburg and Dayton City governments.	Administration of stormwater discharge, Critical Area Ordinances and shoreline master programs
Walla Walla and Columbia County governments and WSDOT	Continue to maintain roads and roadside ditches to prevent entry of sediment into area waterways
Private and state timber owners	Implement forest management practices as required by Forests and Fish rules
Ranchers	Implement livestock management BMPs to prevent streambank destabilization and erosion
US Forest Service (USFS)	Implement forest management practices as required by the Memorandum of Agreement with Ecology
Ecology	Review if interim targets have been met after deadlines reached, and if not, devise an alternative action plan
Ecology,TMDL advisory group	Evaluate if the water quality samples at points of compliance meet the interim and final

Entity	Responsibilities to be met
	targets
Ecology, TMDL advisory group.	If interim target was not met, develop new action plans to meet target
Ecology, WWCCD and CCD, TMDL advisory group	Determine changes in monitoring sites, tests, or frequency are needed
Ecology, WWCCD, CCD, WSU cooperative extension, Kooskooskie Commons, TMDL advisory group	Review program and frequency for accuracy
Ecology, TMDL advisory group	Review if final TMDL targets have been met, and if not, identify new timeline and BMPs needed.
Cities, Walla Walla and Columbia county governments, and WSDOT	Identify and implement stormwater management plans with any Stormwater Permits issued by the Department of Ecology and/or refer to Ecology's eastern Washington stormwater manual for guidance on general stormwater management
Walla Walla and College Place WWTPs	Monitor and maintain chlorinated pesticides and PCBs wasteload set in NPDES permits and the TMDL

Reasonable Assurances

The ultimate goal of this TMDL is to meet the chronic aquatic toxicity and human health criteria for chlorinated pesticides and PCBs. Maintaining the TMDL goals will be required once compliance has been achieved. Improved water quality will be achieved through the combined efforts of all basin stakeholders. Local involvement and commitment to chlorinated pesticide and PCB problems in the Walla Walla River watershed are substantial and are evidenced by the dedication of the people and organizations involved in the development of this plan. To support this TMDL, Ecology will work cooperatively with all basin stakeholders to promote the implementation of activities contained in this plan.

This water cleanup plan, its TMDL targets, and the associated implementation activities listed in the plan are not in themselves enforceable. However, Ecology is obligated to implement the approved TMDL. Organizations and their commitments under laws, rules, and programs to resolve chlorinated pesticide and PCB problems in the watershed are described below.

Washington State Department of Ecology: Ecology has been delegated authority under the federal Clean Water Act by the U.S. EPA to establish water quality standards, administer the NPDES wastewater permitting program, and enforce water quality regulations under Chapter 90.48 RCW. Ecology responds to complaints, conducts inspections, and issues NPDES permits as part of its responsibilities under state and federal laws and regulations. In cooperation with conservation districts, Ecology will pursue implementation of BMPs for agricultural and other land uses and may use formal enforcement, including fines, if voluntary compliance is unsuccessful.

The Ecology/Conservation District MOA: Ecology has a Memorandum of Agreement (MOA) with conservation districts, signed in 1988, that allows Ecology to refer agriculture-related water quality complaints to the conservation districts for resolution of the problems. (However, Ecology will investigate and seek resolution of all complaints that appear to need immediate action.) Conservation Districts have authority under Chapter 89.08 RCW to develop farm plans to protect water quality and provide animal waste management information, education, and technical assistance to residents on a voluntary basis. When a complaint is referred to a conservation district by Ecology, the conservation districts will meet with the owner/operator of the property where the violation occurred, assist the owner/operator in the development of a water quality management plan, provide technical assistance to complete the plan and monitor plan implementation, notify Ecology regarding the owner/operator's willingness to correct the problem and successful implementation of the water quality management plan, and annually submit to Ecology a formal summary of progress on referred water quality violations. While Ecology maintains lead enforcement responsibility for resolution of the referred complaints, this MOA expedites and streamlines correction of agricultural water quality violations.

The TMDL Advisory Group: A TMDL advisory group was formed to direct and support development of the *Walla Walla River Chlorinated Pesticides and PCBs Total Maximum Daily Load Submittal Report.* In such capacity, the advisory group may make suggestions for modifications to the TMDL report. The majority of members of the advisory group are key community members with interests in compliance, and who promote the success of implementation. The group is a highly functional group and is dedicated to meeting the goals of the TMDL.

State of Oregon DEQ: Since approximately a quarter of the Walla Walla basin lies in Oregon, the implementation work underway in Oregon has the potential to positively affect water quality in the Washington portion of the river. As is the case in Washington, the water quality standards program in Oregon is a joint effort between the Department of Environmental Quality (DEQ) and the EPA. DEQ is responsible for developing and enforcing water quality standards that protect beneficial uses such as drinking water, coldwater fisheries, industrial water supply, recreation, and agricultural water supply. The EPA develops regulations, policies, and guidance to help Oregon implement the program and to ensure that Oregon's adopted standards are consistent with the requirements of the Clean Water Act and relevant regulations. The EPA has authority to review and approve or disapprove state standards and, where necessary, to promulgate federal water quality rules. DEQ has the authority and the responsibility to ensure that TMDLs are completed and submitted to EPA. Although no TMDLs are being developed for chlorinated pesticides and PCBs in Oregon, a TMDL is in progress for temperature. It is thought that many of the actions recommended to reduce temperature problems (e.g., riparian restoration and re-vegetation) may also help to reduce sediment loads from soil erosion.

*Regulatory Programs***:** there are a number of local, state, and federal regulatory programs that are already in existence which can be expected to help reduce the chlorinated pesticide and PCB problem in the Walla Walla River and its tributaries. Local regulatory programs include: land use planning/permitting and its associated programs, including Critical Areas Ordinances and Shoreline Master Programs which are administered by county and city governments**.**

State regulatory programs: Discharge permits, including stormwater discharge, impact water quality through management of erosion and suspended sediment and other pollutants. Ecology recently completed a stormwater management manual for eastern

Washington which is designed to guide local authorities as to how best to meet new stormwater discharge regulations. More specifically, Ecology is in the process of developing general stormwater discharge permits for various cities in the Walla Walla basin. When these are finalized, they will help regulate the stormwater component of the chlorinated pesticide and PCB problem. Other state regulatory programs include wetland protection programs, the implementation of forest practices that minimize water quality impacts under RCW 76.09, the enforcement of Shoreline Management legislation and general environmental review under the SEPA.

Federal regulatory programs: The Safe Drinking Water Act (SDWA) contains provisions related to surface and groundwater quality including required monitoring of public water systems and requirements for development of Wellhead Protection Plans.

A unique settlement agreement was reached in 2000 between the three largest irrigation districts (Walla Walla River, Hudson's Bay Improvement and Gardena Farms) and the USFWS. This agreement (and its extension signed in 2001) dictated increased instream flows and more gradual fluctuations to be maintained in the Walla Walla River. These efforts are intended to improve temperature conditions and increase habitat connectivity and may help reduce sediment loads in turn reducing levels of toxins in the water column though this is yet to be determined. A bi-state habitat conservation plan (HCP) is being developed as a follow up on activity to the settlement agreement, and includes other parties such as the city of Walla Walla

Non-Regulatory Programs: In addition to the regulatory programs in place, there are local, state, and federal non-regulatory programs that may also have beneficial impacts on the chlorinated pesticide and PCB problem. Local non-regulatory programs include conservation district, Natural Resource Conservation Service (NRCS), and WSU Cooperative Extension Programs designed to reduce erosion and sediment loading to surface waters, improve water quality monitoring, or vegetate riparian areas. Conservation districts have authority under Chapter 89.08 RCW to develop farm plans to protect water quality and provide animal waste management information, education, and technical assistance to residents on a voluntary basis. Also, county governments are involved in water quality improvements in a variety of programs including, but not limited to, applying for state grants on behalf of landowners.

State non regulatory programs: State management of several funding programs is designed to assist various parties in improving water quality. These programs include the Centennial Clean Water Fund, Washington State Water Pollution Control Fund, Clean Water Act Section 319 Nonpoint Source Fund, and participation in Conversation Reserve Enhancement Program (CREP) (state obligation ten percent). The Washington Department Fish and Wildlife (WDFW) manages the Watershed Recovery Project that involves collecting information about land use practices and water quality within watersheds. The information is collected into a usable format to assist watershed managers to prioritize improvement~~s~~ programs. Also there are various forestry easement programs described in the Department of Natural Resources (DNR) Forest Practices Rules (WAC 222).

Federal Non-Regulatory Programs: The U.S. Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) and USDA Farm Service Agency

(FSA) administers programs such as the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program CREP, the Continuous Conservation Reserve Program (CCRP), the Environmental Quality Incentives Program (EQIP), the Wildlife Habitat Incentives Program (WHIP), the Grassland Reserve Program (GRP), and the Wetlands Reserve Program (WRP).

Comprehensive Irrigation District Management Plan (CIDMP): The executive committee of the Irrigation Districts' Guideline development process, in collaboration with CTUIR and various other stakeholders, recently completed a manual (Comprehensive Irrigation District Management Plan) that sets up a voluntary and incentive-based process for improving irrigation district operations in response to the Endangered Species Act and the Clean Water Act. Specifically, the manual describes an innovative and assertive approach to water quality problem assessment, monitoring, outreach, BMP implementation, and adaptive management. Many of the activities outlined in this manual may have potential beneficial impacts on the sediment load and toxin problem in the Walla Walla River.

The United States Forest Service(USFS)/Ecology MOA: In 2000, the USFS – Region 6 and Ecology signed a Memorandum of Agreement (MOA) addressing protection of water quality on federal forest lands in Washington State. As part of the required actions under this MOA, the USFS is actively working to maintain and improve roads that may cause the entry of sediment into area waterways. The USFS has also developed several programs to restore damaged riparian areas and to educate the public regarding respect for rivers and riparian areas. All of these efforts will directly support this TMDL and help to ensure its success.

Besides the general assurances listed above, there are a host of specific water quality enhancement activities already completed or underway in the Walla Walla basin that are helping to meet TMDL chlorinated pesticide and PCB targets. These activities are summarized in Table18.

Table 18. Miscellaneous existing projects related to water quality improvement in WRIA 32. (Taken from the preliminary draft of the Walla Walla Watershed Plan, January 2005 – see Appendix B.)

Project	Lead Agency	Duration	Comments
Couse Creek riparian enhancement (OR)	CTUIR (BPA funded)	1996-1998	
Stream flow enhancement	WWRID, GFID,HBIC, USFWS	1999-2002	
Upland restoration planning	NRCS, WDFW	Ongoing	
Implementation of conservation tillage	Landowners/Conservation Districts/NRCS/WSU Extension	Ongoing	
Installation of other on-farm BMPs	Landowners, WWCCD, CCD, NRCS, WSU Extension	Ongoing	Included installation of terraces, sediment basins, and vegetated filter strips; enrollment of landowners in CRP & CREP
Riparian buffer	Landowners, NRCS,	Ongoing	Areas like the South

Project	Lead Agency	Duration	Comments
restoration (CREP & others)	CTUIR (BPA funds), FSA & Conservation Dists.		Fork Patit and Blue Creek
Various riparian and instream restoration projects	Landowners, NRCS, and Tri-state Steelheaders	Ongoing	
College Place stream restoration &	City of College Place	1998-2001	Along Garrison Creek
Treatment wetland/WWTP Improvements	City of College Place	Ongoing	
Walla Walla WWTP improvements	City of Walla Walla	1999-2000	Various improvements
Dayton WWTP improvements	City of Dayton	1999-2000	
Waitsburg WWTP improvements	City of Waitsburg	2001-2001	Various improvements and new construction
Household hazardous waste collection	Ecology, Landowners, City and County Agencies	Ongoing	
Livestock removal	Landowners, NRCS	Ongoing	Remove direct stream access for livestock and reduce total livestock presence
Irrigation efficiency	Landowners and City/County Agencies	Ongoing	
Forest practices	Landowners and City/County/State Agencies	Ongoing	Reduces upland erosion
Increasing industrial chemical control and accountability	Ecology, Landowners, Business, City and County Agencies	Ongoing	

Adaptive Management

Adaptive management has been defined in state law as “reliance on scientific methods to test the results of actions taken so that the management and related policy can be changed promptly and appropriately” (RCW 79.09.020). It may be described as a cycle that occurs in four stages: (i) identification of information needs, (ii) information acquisition and assessment (monitor), (iii) evaluation and decision-making (evaluate), and (iv) management action or response (respond). Oftentimes, the first and fourth stages can be considered as one, since part of the response to newly evaluated data may be to identify new information needs. Thus, the key stages of the adaptive management cycle are to “monitor”, “evaluate”, and “respond.” Adaptive management is a continuing attempt to reduce the risk arising from the uncertainty associated with information used to develop the management actions. Generally speaking, each stage of the cycle has an associated uncertainty that should decrease through each completed cycle of the process.

This is one perspective to applying adaptive management. An alternative way to look at adaptive management is to consider it as “experimental management” wherein the management actions taken are used to test key hypotheses and assumptions used to develop the management actions. There are subtle differences in application, but conceptually they are similar in that adaptive management attempts to address uncertainty in information. In this TMDL, adaptive management specifically refers to a process whereby the advisory group and Ecology devise new implementation strategies in the event that monitoring shows targets are not being met. A feedback loop is implemented consisting of the following three steps.

Step 1. The water quality improvement plan and associated action items are implemented. Programs and on-site BMPs are evaluated for technical adequacy of design and installation.

Step 2. The effectiveness of the water quality improvement plan in achieving the goal and objectives is evaluated by comparison to water quality monitoring data. If the goal and objectives are achieved, the implementation efforts are adequate as designed, installed, and maintained. If not, the plan is modified and objectively reevaluated.

Step 3. Project success and accomplishments should be publicized and reported to continue project implementation and support.

Where new (not previously identified) sources of suspended sediment bearing chlorinated pesticides and PCBs are discovered, they will be remedied through the appropriate jurisdiction. If or when planned implementation activities are not producing expected or required results, Ecology or other entities may choose to conduct additional studies to identify the significant sources of toxin input to the river system. If the causes can be determined, additional implementation measures may be needed. If the shortfall does not have an apparent cause (e.g., everyone is implementing required BMPs and all potential sources have been addressed, but targets are not being met), then more studies may be required. Conversely, should water quality standards be met prior to achieving the specific target allocations outlined here, the purpose of this TMDL shall be satisfied. Re-evaluation of the status of this TMDL will be conducted every five years. For non-federal forested areas, the agreements in the forests and fish report incorporate adaptive management as needed to ultimately meet state water quality standards. The USFS also has a policy of adaptive management.

Regular monitoring is essential to ensure successful implementation of an adaptive management strategy. The monitoring strategy is discussed in detail below.

Monitoring Strategy

The EPA calls for a monitoring plan for TMDLs where implementation will be phased over time. The monitoring is conducted to provide assurance that the control measures will meet the TMDL targets and achieve water quality standards. Long-term monitoring will be important to ensure fulfillment of the Walla Walla River TMDL for chlorinated pesticides and PCBs. Ecology is the lead agency for monitoring the implementation activities and will coordinate with the appropriate watershed entities to accomplish these efforts.

A distinction should be made here between implementation monitoring and effectiveness monitoring. Implementation monitoring can begin at any time and is usually more dispersed and on a larger scale than effectiveness monitoring. Because the cost of sampling toxin concentrations directly on the scale required in this phase of monitoring will probably be prohibitive, TSS and/or turbidity will be used here as surrogate measures of toxicity. The goal of implementation monitoring is to pinpoint the most significant sources of contamination. Effectiveness monitoring is conducted five years after completion of the detailed implementation plan (DIP) and its primary purpose is to determine whether implementation activities have been put into effect and whether the water body is in compliance with state water quality standards. Unlike implementation monitoring, effectiveness monitoring typically requires assessing toxin concentrations directly using SPMDs and fish tissue samples.

A TMDL must include monitoring to measure achievement of targets and water quality standards. NPDES permits require point sources to regularly monitor their discharge effluent. Monitoring data from the Walla Walla and College Place WWTPs will be included with data collected as part of a general monitoring strategy for watershed. The goal of monitoring would be to determine if land use changes are effective in reducing TSS loading to the Walla Walla River and bringing the river into compliance with standards. Objectives should include 1) obtaining accurate and representative data on TSS and turbidity in the mainstem Walla Walla River and major tributary sources of TSS, 2) using the data to assess progress toward meeting water quality targets, 3) re-surveying fish and the water column to verify that human health standards for chlorinated pesticides and PCBs are being met, 4) re-assessing the accuracy of the 2 mg/L:1 NTU and 1 mg/L:<1 NTU targets for the mainstem, and 5) developing water quality targets to protect high fish consumers in the East Little Walla Walla River and in Yellowhawk Creek.

The Walla Walla Watershed Planning Unit developed a sediment model using the SWAT (Soil Water Assessment Tool) model in their efforts to assess the positive impact of alternative agricultural BMPs implemented in the basin (EES., 2003). The model was used to analyze the erosion and sediment characteristics of the basin as impacted by historical and current (or projected) agricultural practices. Both the planning unit and Ecology have access to this model and it could be further developed to conduct a basin wide modeling study or to focus on specific drainage areas within the basin. In addition, the model could be used to help evaluate the stream loading associated with other water quality parameters individually or as affected by sediments.

Water quality monitoring should begin with collecting one year of baseline data on TSS and turbidity at the ten sites listed below. Sampling should be conducted at least twice weekly, similar to what is being done for effectiveness monitoring in the Yakima TMDL. In order to obtain representative and comparable data, depth integrating sampling procedures should be used. Streamflow should be measured.

The following sampling sites are suggested for TMDL effectiveness monitoring:

1. Walla Walla River @ state line
2. Yellowhawk Creek
3. East Little Walla Walla River
4. Garrison Creek
5. Mill Creek
6. Dry Creek
7. Pine Creek
8. Touchet River
9. Gardena Creek
10. Lower Walla Walla River @ Cummins Bridge

Once significant land use changes are deemed to have occurred, twice-weekly samples would be collected from January through June, the critical period for TSS loading. The pre- and post-data for January-June would be tested for significant differences and the 90th percentile values compared to the numerical targets. January-June monitoring would continue on a yearly or less frequent basis, depending on results of the comparisons and pace at which land use changes proceed in the watershed. Monitoring in July-December would be phased in as appropriate to assess progress in meeting the more restrictive targets.

As the water quality targets for TSS and turbidity are progressively achieved, chlorinated pesticides and PCBs should be analyzed periodically in resident mainstem fish species and the water column. PCBs should also be analyzed in fish samples from Mill and Garrison creeks. Sample size for fish should be appropriate for making a statistical comparison with criteria used to assess compliance with human health standards and WDOH should be consulted on the sampling design. Water column sampling and analysis should employ low-level techniques. Water samples should be focused on the mainstem and include the East Little Walla Walla River and Yellowhawk Creek. TSS and turbidity samples should be collected in conjunction with the pesticide sampling.

A quality assurance project plan (QAPP) should be prepared for whatever monitoring is conducted. The QAPP should follow Ecology guidelines (Lombard and Kirchmer, 2004) paying particular attention to consistency in sampling and analytical methods.

In addition to the effectiveness monitoring detailed above, it is recommended that follow-up monitoring work be done to answer key questions not answered in the TMDL chlorinated pesticide and PCB evaluation:

- Chlorinated pesticides and PCBs should be analyzed in sediment samples from the Columbia River backwater in the lower Walla Walla River and an assessment made of potential for uptake of these chemicals by fish and of ecological risk. The rate of sediment deposition should be measured and results used to predict time to recovery under various cleanup scenarios for the upstream watershed.

- An effort should be made to determine if there are remediable PCB sources in the Mill Creek watershed. More intensive sampling of Mill and Garrison creeks may help determine if and where localized sources exist. Other potential sources in the watershed include agricultural, food processing, chemical, scrap, and waste sites.

- It is recommended that as part of a PCB management strategy the WWTPs of Walla Walla and College Place monitor the output of dischargers in their service areas to determine possible contributors of PCBs to their systems. This strategy should also include WWTP effluent sampling to ascertain whether remedial activities are successful in reducing PCB load. Ecology will provide technical assistance wherever possible.

- Additional water sampling is required along Yellowhawk Creek in order to identify possible sources of PCBs. The sampling strategy will be developed in the Detailed Implementation Plan (DIP). No point sources were identified along the Yellowhawk during the TMDL technical study, but if such sources are later identified they will be addressed in NPDES or stormwater permits and monitored regularly to assess compliance with water quality standards.

- The stormwater systems of the cities of Walla Walla and College Place should be sampled for both chlorinated pesticides and PCBs to ascertain how much if any these are contributing to the problem - information which can be incorporated in future stormwater discharge permits.

- Sampling should be conducted to locate toxaphene sources in the Pine Creek drainage. Because of the analytical challenges presented by toxaphene, some kind of pre-concentration technique may be required to obtain useful data.

Funding

Potential funding sources available through Ecology's water quality grants program include the Centennial Clean Water Fund, Section 319 grants under the federal Clean Water Act, and the State Revolving Fund (SRF) grants. In addition to Ecology's funding programs, there are many other funding sources available for watershed planning and implementation, point and nonpoint source pollution management, fish and wildlife habitat enhancement, stream restoration, and education. Public sources of funding include federal and state government programs, which can offer financial as well as technical assistance. Private sources of funding include private foundations, which most often fund nonprofit organizations with tax-exempt status. Forming partnerships with other government agencies, nonprofit organizations, and private businesses can often be the most effective approach to maximize funding opportunities.

The NRCS directs its Environmental Quality Incentives Program (EQIP). EQIP provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program is implemented through conservation plans that include structural, vegetative, and land management practices. Contracts are five to ten years long. The USDA FSA administers the Conservation Reserve Enhancement Program (CREP) and Conservation Reserve Program (CRP), both of which the NRCS has technical responsibility over. These are both voluntary cost share programs designed to restore and enhance habitat and increase bank stability along waterways on private lands. A cropping history is needed to be eligible for CRP but not for CREP. Marginal pasture lands are also eligible. The NRCS provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. These programs offer payments for annual rental, signing, cost share, practice, and maintenance in exchange for removing land from production and grazing, under 10-15 year contracts. Additionally, the NRCS can initiate funding under Public Law 83-566, the Watershed Protection and Flood Prevention Act. This federal law can fund watershed projects that include watershed protection, water quality improvements, soil erosion reduction, irrigation water management, sedimentation control, and fish and wildlife habitat enhancement.

The Walla Walla County and Columbia conservation districts provide cost-share programs to irrigators and ranchers for riparian restoration, farm programs, and irrigation conversion programs - all of which could help reduce sediment loads in the Walla Walla River and its tributaries. These conservation districts could also help to provide polyacrylamide (PAM) to farmers that when applied to the soil helps to reduce soil erosion. Cost-share can and should be sought by all cooperating groups, but it should be recognized that implementation of BMPs (with or without cost share) requires that individual landowners make an investment in the practice.

Because much of the Walla Walla basin is considered critical ESA habitat for bulltrout and summer steelhead, state and federal funding is available for endangered fish species projects, which will probably help support implementation under this TMDL. The Walla Walla Watershed Planning Unit will have access to funding for projects that will further help ameliorate the conditions responsible for the chlorinated pesticide and PCB problem in the area.

CTUIR is involved with a number of habitat, hatchery, harvest, and hydrosystem restoration actions that will ultimately result in increased fish production in the Walla Walla and increased tribal consumption of Walla Walla fish. CTUIR's involvement in the sub basin provides additional opportunities for funding including but not limited to cost-matching from non-federal rate payer Bonneville Power Administration, EPA tribal gap, and Bureau of Indian Affairs money. These resources may be available to assist in on-the-ground science such as fish collections and toxins sampling, and are already in place to develop and implement habitat restoration projects that may ultimately result in decreased chlorinated pesticide levels.

Summary of Public Involvement

Public involvement is vital in any TMDL. Nonpoint TMDLs are successful only when the watershed landowners and other residents are involved, since they are the closet to and most knowledgeable of the watershed resources. Ecology's *TMDL Evaluation of Chlorinated Pesticides and PCBs in the Walla Walla River, published in October of 2004*, was subjected to public review and comment. Much of the material in this submittal report is based on that publication. In early 2005, a TMDL advisory group was founded to discuss issues and make recommendations to Ecology in the development of this TMDL. Ecology also maintains a mailing list of interested parties so that information is readily available to other agencies and the public on matters concerning the TMDL process. The submittal report is opened to public review and comment before submittal to the EPA.

The Walla Walla basin has a host of local, state, federal and tribal agencies, and non-governmental organizations involved in conservation activities associated with the mainstem and its tributaries. Many private landowners in the area are also intimately involved with these conservation efforts. Ecology will continue to take steps to try and ensure participation and cooperation from *all* the great diversity of interested parties in this TMDL.

Involving stakeholders in the basin is the key to executing management strategies and actions. Examples of organizations to contact in targeted outreach efforts during implementation include:

- County Conservation Districts and Farm Bureaus.
- Walla Walla Backyard Stream Team.
- Washington State University Cooperative Extension.
- Confederated Tribes of the Umatilla Indian Reservation (CTUIR).
- Agricultural commodity groups and trade associations.

- Environmental organizations (Blue Mountain Land Trust, CELP, American Rivers) and civic organizations.
- Walla Walla Watershed Alliance, Kooskooskie Commons and Native Creek Society.
- Walla Walla County Watershed Planning Department.
- County Commissions and City Councils.
- Tri-State Steelheaders and other hunting, fishing and outdoor recreation interest groups.
- Irrigation districts and organized ditch irrigators.
- Agri-businesses and timber companies.
- Economic development organizations.
- Colleges (Walla Walla Community College, Whitman College and Walla Walla College); and individual landowners.
- Government agencies such DOH, WDFW, USDA-NRCS, USFS, and ODEQ and ODFW
- Walla Walla Basin Watershed Council (in Oregon).
- Oregon State University Cooperative Extension.

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Appendix A

A Total Maximum Daily Load Evaluation for Chlorinated Pesticides and PCBs in the Walla Walla River

By Art Johnson, Brandee Era-Miller, Randy Coots, and Steve Golding

October 2004
Publication No 04-03-032

This report is available on the Department of Ecology home page on the World Wide Web at http://www.ecy.wa.gov/biblio/0403032.html

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Appendix B

Walla Walla Watershed Plan
Preliminary Draft

By HDR/EES, Inc.

January 2005

This report is available on the Walla Walla Watershed Planning home page on the World Wide Web at http://www.wallawallawatershed.org/wsplanning.html#documents

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HDR/EES, Inc.
2805 St. Andrews Loop, Suite A
Pasco, Washington 99301

Appendix C

Stormwater Management Manual for Eastern Washington

Prepared By: The Washington State Department of Ecology's Water Quality Program

September 2004
Publication No. 04-10-076

This report is available on the Department of Ecology home page on the World Wide Web at http://www.ecy.wa.gov/biblio/0410076.html

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Appendix D

Model Municipal Stormwater Management for Eastern Washington

Prepared By: The Washington State Department of Ecology's Water Quality Program

September 2003
Publication No. 03-10-076

This report is available on the Department of Ecology home page on the World Wide Web at http://www.ecy.wa.gov/biblio/0310076.html

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Appendix E

Upper Yakima River Basin Suspended Sediment, Turbidity and Organochlorine Pesticide Total Maximum Daily Load, Submittal report.

Prepared By: Jane Creech and Joe Joy

August 2002
Publication No. 02-10-047

This report is available on the Department of Ecology home page on the World Wide Web at http://www.ecy.wa.gov/biblio/0210047.html

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Appendix F

By Congressional mandate, the **Agency for Toxic Substances and Disease Registry (ATSDR)** produces "toxicological profiles" for hazardous substances found at National Priorities List (NPL) sites. These hazardous substances are ranked based on frequency of occurrence at NPL sites, toxicity, and potential for human exposure.

Further information:

- **ATSDR ToxProfiles 2004™** CD-ROM - The toxicological profiles are also available as a complete set on CD-ROM.
- **Public Health Statements (PHS)** - The PHS are a series of summaries about hazardous substances taken from Chapter One of their respective ATSDR Toxicological Profiles.
- **ATSDR ToxFAQs™** - The ToxFAQs™ are a series of 2-page fact sheets about hazardous substances.

To request a copy of the ToxProfiles™ CD-ROM, PHS, or ToxFAQsTM call 404-498-0261 or email your request to atsdric@cdc.gov.

For more information on the above listed publications, write

Division of Toxicology, Agency for Toxic Substances and Disease Registry
1600 Clifton Road, Mailstop F-32, Atlanta, GA 30333

For more information 24 hours/day

You may call the ATSDR toll free number at 1-888-42-ATSDR (1-888-422-8737) to get 24-hour recorded information about Division of Toxicology programs. This phone number includes options to be transferred to ATSDR personnel for technical assistance.

ATSDR Internet home page via World Wide Web: http://www.atsdr.cdc.gov

The profiles, public health statements, ToxFAQs™ and other information are available on the Internet.

Appendix G

Acronyms and Abbreviations

BMP	Best Management Practice
CAO	Critical Areas Ordinance
CAFO	Contained Animal Feeding Operation
CCD	Columbia Conservation District
CD	Conservation District
CIDMP	Comprehensive Irrigation District Management Plan
CRB	Columbia River Basalts
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CTUIR	Confederated Tribes of the Umatilla Indian Tribes
CWA	Clean Water Act (Federal)
DEQ/ODEQ	Oregon Department of Environmental Quality
DOE/Ecology	Washington State Department of Ecology
DOH	Washington State Department of Health
DDD	Dichlorodiphenyl Dichloroethane
DDE	Dichlorodiphenyl Dichloroethylene
DDT	Dichlorodiphenyl Trichloroethylene
EES	Economic and Engineering Services, Inc.
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act (Federal)
GPS	Global Positioning System
HCP	Habitat Conservation Plan
MOA	Memorandum of Agreement
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NTR	National Toxics Rule
NTU	Nephelometric Turbidity Unit
ODFW	Oregon Department of Fish and Wildlife
OFM	Washington State Office of Financial Management
PCB	Polychlorinated Biphenyl
RCW	Revised Code of Washington
RM	River Mile
SPMD	Semipermeable Membrane Device

TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USFS	U.S. Forest Service
USGS	U.S. Geologic Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA 32	Water Resource Inventory Area (Walla Walla Basin)
WSU	Washington State University
WWCCD/WWCD	Walla Walla County Conservation District
WWTP	Wastewater Treatment Plant
mg/L	milligrams per liter (parts per million)
ug/L	micrograms per liter (parts per billion)
ng/L	nanogram per liter (parts per trillion)
ug/Kg	micrograms per kilogram (parts per billion)